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A Visual Overview of World Oil Markets

Kay McKeough,
Jose Escay,
and
Sompheap Sem

Oil consumption is expected to increase far more in the developing countries than in the industrial nations by the year 2000 — as the industrial nations shift to a service economy and the developing nations industrialize.

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Energy Development

Total world demand for oil is expected to increase about 27 percent in the period 1985-2000, from 57 million barrels a day (mmb/d) to 73 mmb/d.

Demand in the centrally planned economies (in which industry has been protected from the effects of the oil shocks) should remain about the same.

Oil consumption in the industrial countries is expected to grow only 19 percent in the same period.

But the demand in the developing countries should grow about 50 percent from about 16 mmb/d in 1985 to 24 mmb/d in the year 2000. No other group of countries will experience so great an increase in demand for oil.

As a result of "industrialization" shifts from the industrial countries to the developing nations, oil consumption in the industrial sectors of less developed countries has remained predominant over their transportation sectors. This has important ramifications for fuel substitution, efficiency improvements, and other policies.

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A Visual Overview of the World Oil Markets

I. INTRODUCTION

The shock waves of the oil price increases in the 1973-1974 and 1979-1980 periods showed vividly that crude oil is one of the most important natural resources in terms of its impact on the economic performance of countries. Therefore, a country's dependency on crude oil cannot be understated even during a period of plentiful supplies and lower prices. This paper focusses on worldwide oil demand and, in particular, the oil consumption in the developing countries. Based on World Bank forecasts, their demand is expected to increase 50% from 1986 and reach approximately 24 million barrels daily by the year 2000. This means that they will need an additional 3 billion barrels annually to meet their oil needs. No other group of countries will experience this same magnitude of increase. While the volumes of oil that the developing nations consume today may seem small compared to that in industrialized countries, it is important to note that their share of total world oil demand will increase to one-third by the year 2000.

These forecasts are based on a World Bank model which is reflective of assumptions regarding future global economic activity, the economic performance of individual countries, prices and other factors. Obviously, these assumptions may not come to be accurate which would mean different oil demand behavior. Nevertheless, these forecasts are indicative of trends in the developing countries' share of the world's oil consumption. These graphs are not intended to pinpoint oil demand in any given year but to place these overall trends in perspective. That is, the trends of the developing countries' oil demand is compared to the trends in industrialized countries, centrally planned economies, and the total world. For purposes of this paper, the centrally planned economies include the U.S.S.R., Eastern Bloc countries, China, North Viet Nam, North Korea and Cuba. Since many companies and organizations give forecasts only for the non-centrally-planned economies, which include developing countries and the industrialized world, trends are given for comparative purposes for this category as well.

Section II provides an overview of oil consumption illustrating oil consumption in terms of volume from 1961-2000.

Section III compares these oil consumption patterns to oil price trends since they are an important indicator in the determination of oil demand. It illustrates oil price trends in current and constant (1985) dollars and discusses briefly some factors, including cyclical patterns in the oil industry and business cycles, that could affect prices.

Section IV compares oil consumption to total energy consumption. Oil is an important source of energy, comprising just under half of total energy consumption, but its share is expected to diminish. The graphs show that developing countries are more oil-intensive than world averages; however they follow the worldwide trend to reduce the percentage share of oil in their total energy balance.

Section V portrays forecasts of oil consumption until the year 2000 and linear extrapolations until 2010. It emphasizes that, despite the small volumes of oil consumed by LDCs as compared to other country groups, LDCs are expected to have the highest growth in oil demand from the years 1985-2000. Their oil demand should increase approximately 50% while in the same period, industrial countries' oil consumption is expected to grow only by 19%.

Section VI breaks down oil consumption into three major sectors: Industry (industry and electric power), Transport and Other (residential and commercial) and cross-references this data by country group. Due to the de-industrialization of industrial countries and the consequent industrialization of developing countries, there is a much higher oil usage in the latter's industrial sector than might otherwise be expected and higher than in their transportation sector. This sector usage has important ramifications for fuel substitution and other energy policies.

II. OVERVIEW OF OIL CONSUMPTION

This Overview of Oil Consumption highlights the increased growth of oil consumption in the developing countries that is forecast between now and the year 2000. Their consumption should grow about 50%, from approximately 16 million barrels daily to 24 mmb/d in this time period. No other country group is predicted to experience the same rate of growth; the centrally planned economies should experience rather flat demand and the industrialized countries, slight increases. Thus, the slope of the demand for the non-centrally planned economies is relatively steep since it takes into account the higher consumption rates of developing countries along with the more mild increases in the industrialized countries.

The total world's demand closely mirrors that of the non-centrally planned economies, with the total world experiencing an increase of about 27%, from 57mmb/d to some 73 mmb/d by the year 2000 (Figure 1).

WORLD OIL CONSUMPTION
ACTUAL AND FORECAST

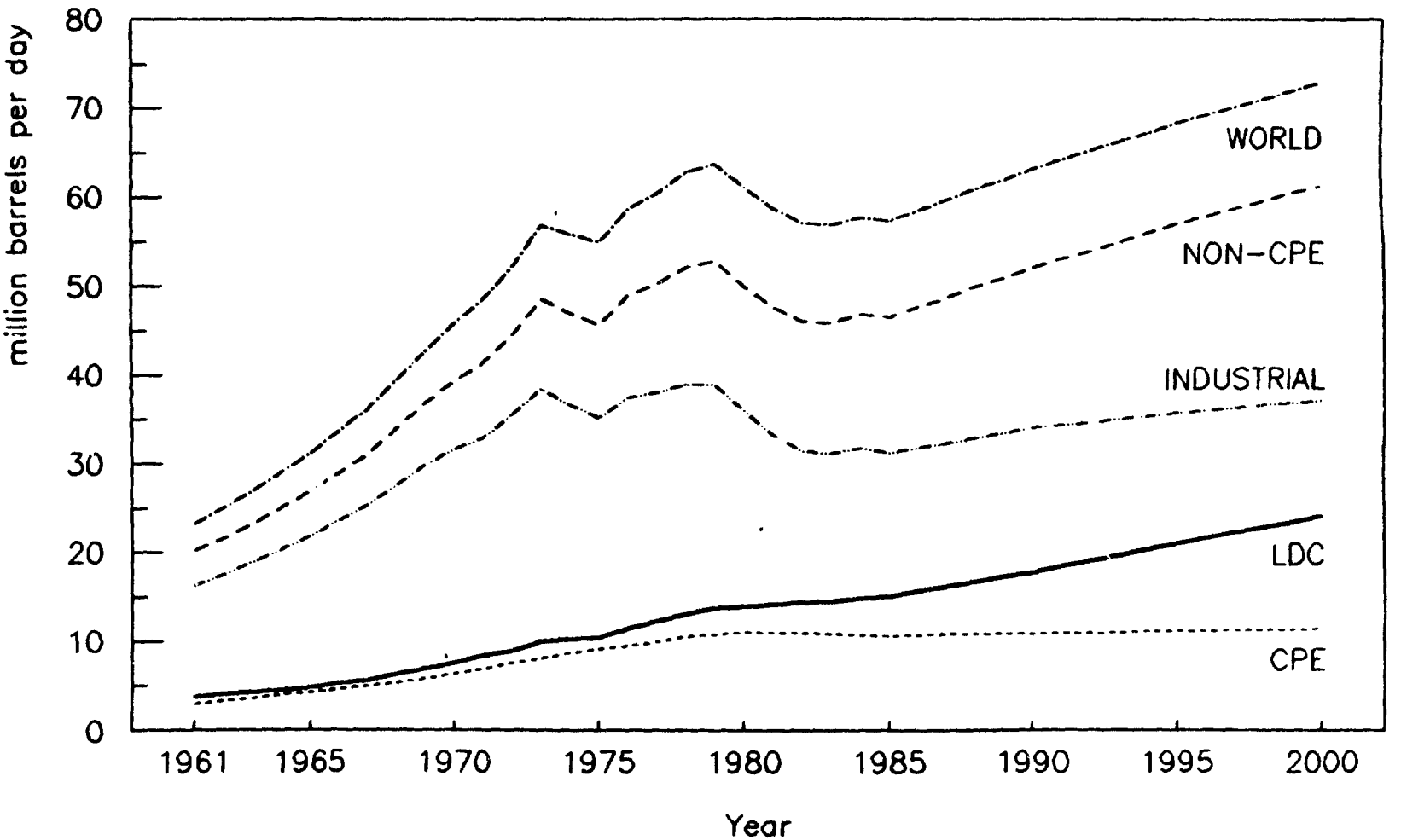


Figure 1

III. OIL CONSUMPTION VERSUS PRICE TRENDS

This section illustrates the trends in world oil consumption compared to oil prices and discusses some of the factors that may affect price.

Figure 2 compares total world oil consumption to oil prices as expressed in both constant and current U.S. dollars. From the 1960s to early 1973, there was a steady increase in oil consumption in an era marked by cheap oil prices. In response to the 1973 oil price shock, consumption flattened, but then increased again until the 1979-early 1980s price hikes. Nevertheless, with high inflation in the early 1980s, the price of oil in current dollars overlapped the oil price in constant dollars during this period.

There appears to have been a cyclical pattern in energy pricing whereby oil prices respond to changes in economic activity. This fluctuating economic activity or business cycle will affect the demand for oil and consequently, the price of oil. In addition, factors such as urbanization and population can affect demand.

Similarly, prices are affected on the supply side by the oil industry cycle, characterized by periods of expansion and contraction, whereby higher oil prices generate an increase in investment in the oil sector, bringing on more production, resulting in increased supplies, and eventually a fall in prices. A composite index of various factors can be used to identify turning points in this industry cycle and the amplitude of each stage of the cycle; the index shown here (Figure 3)[1/] is based on indicators that reflect the current real price of oil, levels of oil industry activity, and the relative performance of oil company shares compared to the stock market in general. Price behavior can also be influenced by supply concentration as evidenced by the responses to OPEC's behavior.

The price of oil depends where we are in the cycle, i.e., the high or low point, and when changes such as a recession occur. According to this theory, oil prices are passing through the bottom of the trough and will be moving on to the next upswing of the cycle (Figure 4)[1/] which should be in the mid-90s. The upswing will be underpinned by a tightening of supplies and expansion of demand.

1/ Source: World Petroleum Markets A Framework for Reliable Projections, January 1988 Draft Report, prepared by the Petroleum Finance Company Ltd for the World Bank.

WORLD OIL CONSUMPTION vs. CURRENT & CONSTANT PRICES

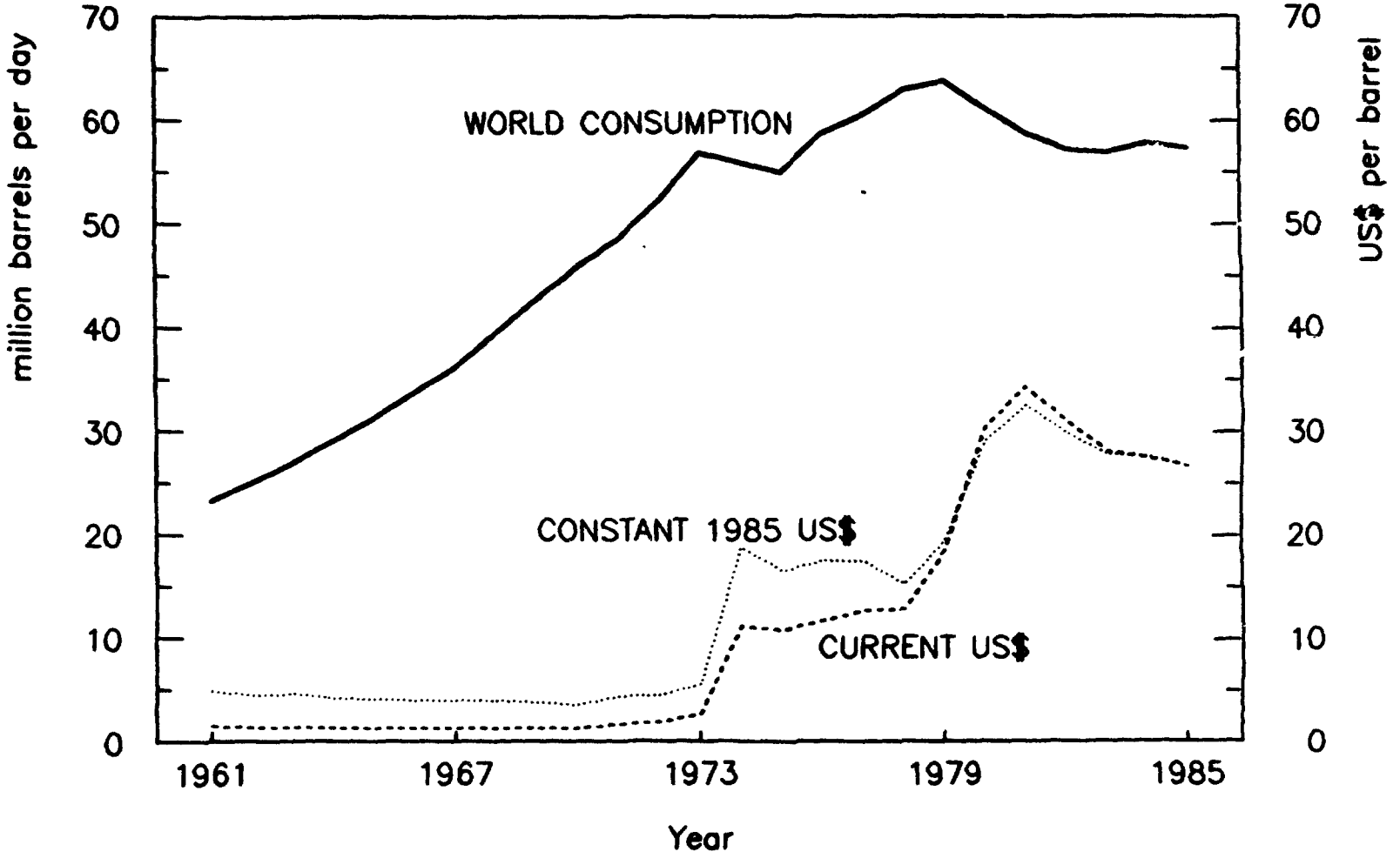


Figure 2

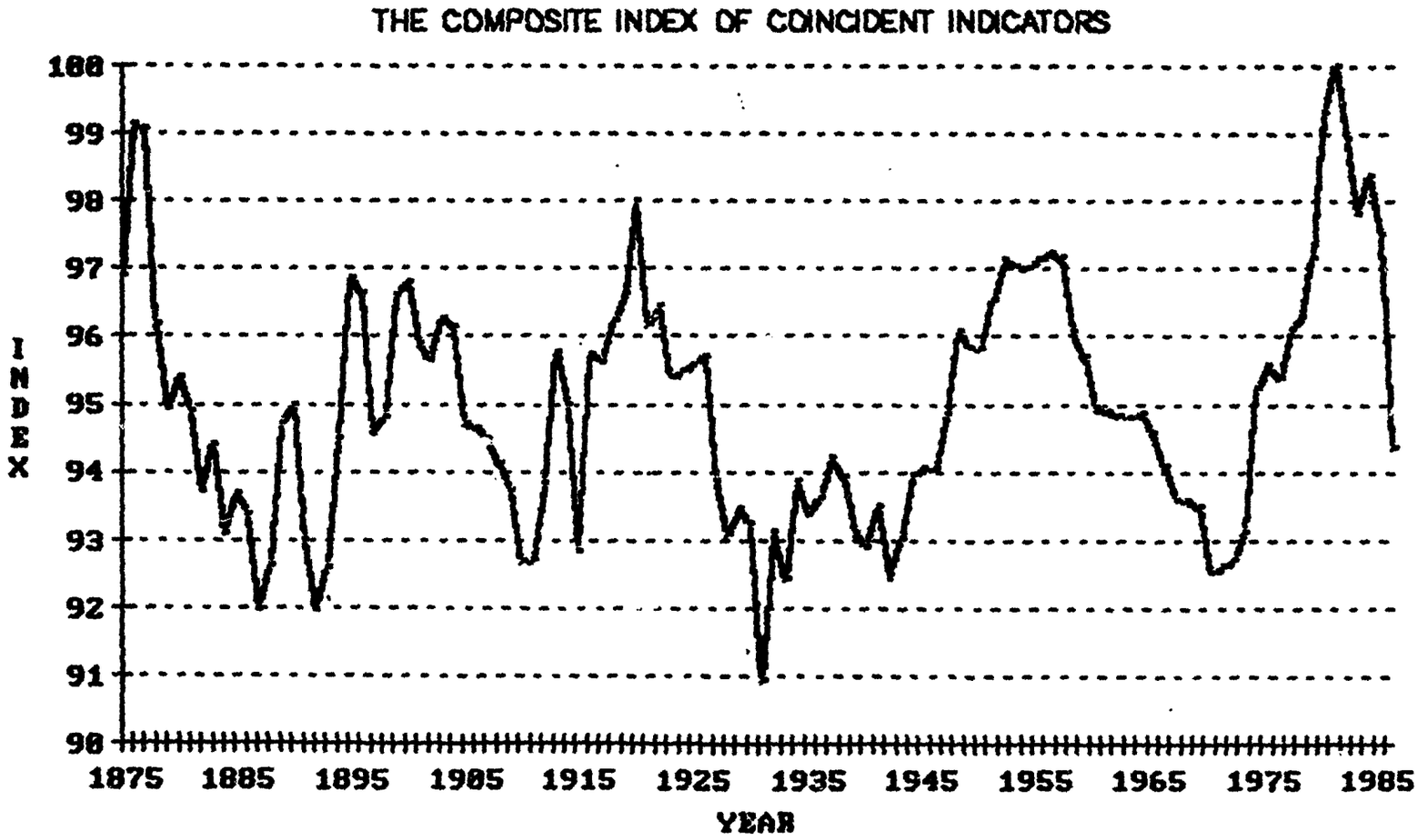
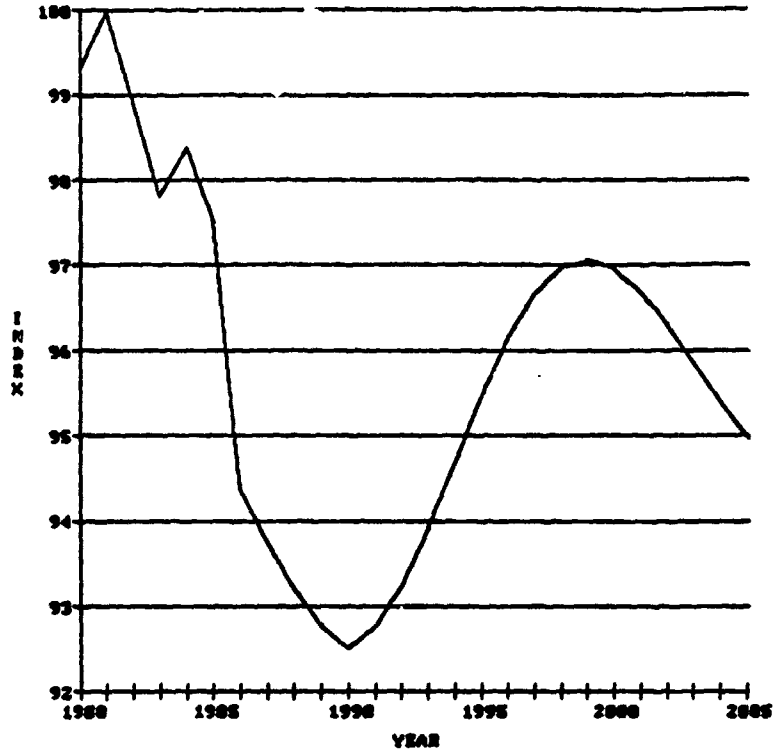

THE COMPOSITE INDEX OF COINCIDENT INDICATORS
100
99
98
97
96
95
94
93
92
91
90
INDEX
1875
1885
1895
1905
1915
1925
1935
1945
1955
1965
1975
1985
YEAR

Figure 3

FIGURE 4

A PROJECTION OF THE PETROLEUM CYCLE
(1988 - 2000)



IV. OIL VERSUS ENERGY CONSUMPTION

Oil is the most important source of energy; therefore, as expected, the oil price shocks in the 1973-1974 and the late 1970s and early 1980s have caused significant fluctuations in total world energy consumption (Figure 5). These fluctuations can be attributed to the dramatic changes in energy consumption experienced in the industrial countries, which were offset by the relatively stable consumption patterns of LDCs and CPEs. During this period, energy consumption of centrally-planned economies appears to be unaffected and has, in fact, maintained fairly constant growth. LDCs, on the other hand, experienced slight fluctuations. Nevertheless, LDC energy consumption has been growing rapidly so that by 1985, it exceeded energy consumption of CPEs.

During the oil price shocks, the patterns of energy consumption of total world and LDCs corresponded closely to their oil consumption patterns (Figure 6) since oil consumption accounts for almost half of energy consumption. However, in the future, energy consumption will continue to grow at a much faster rate compared to oil consumption so oil will account for a smaller percentage of energy consumption.

As illustrated in Figure 7, the oil-intensity of energy consumption in LDCs was higher and more volatile than total world averages from 1961 to the first shock in 1973-1974. Although LDCs are more oil-intensive than world averages, they follow the worldwide trend to increase efficiency and convert to other sources of energy thereby lowering their percentage of oil in their total energy supplies.

WORLD ENERGY CONSUMPTION
ACTUAL AND FORECAST

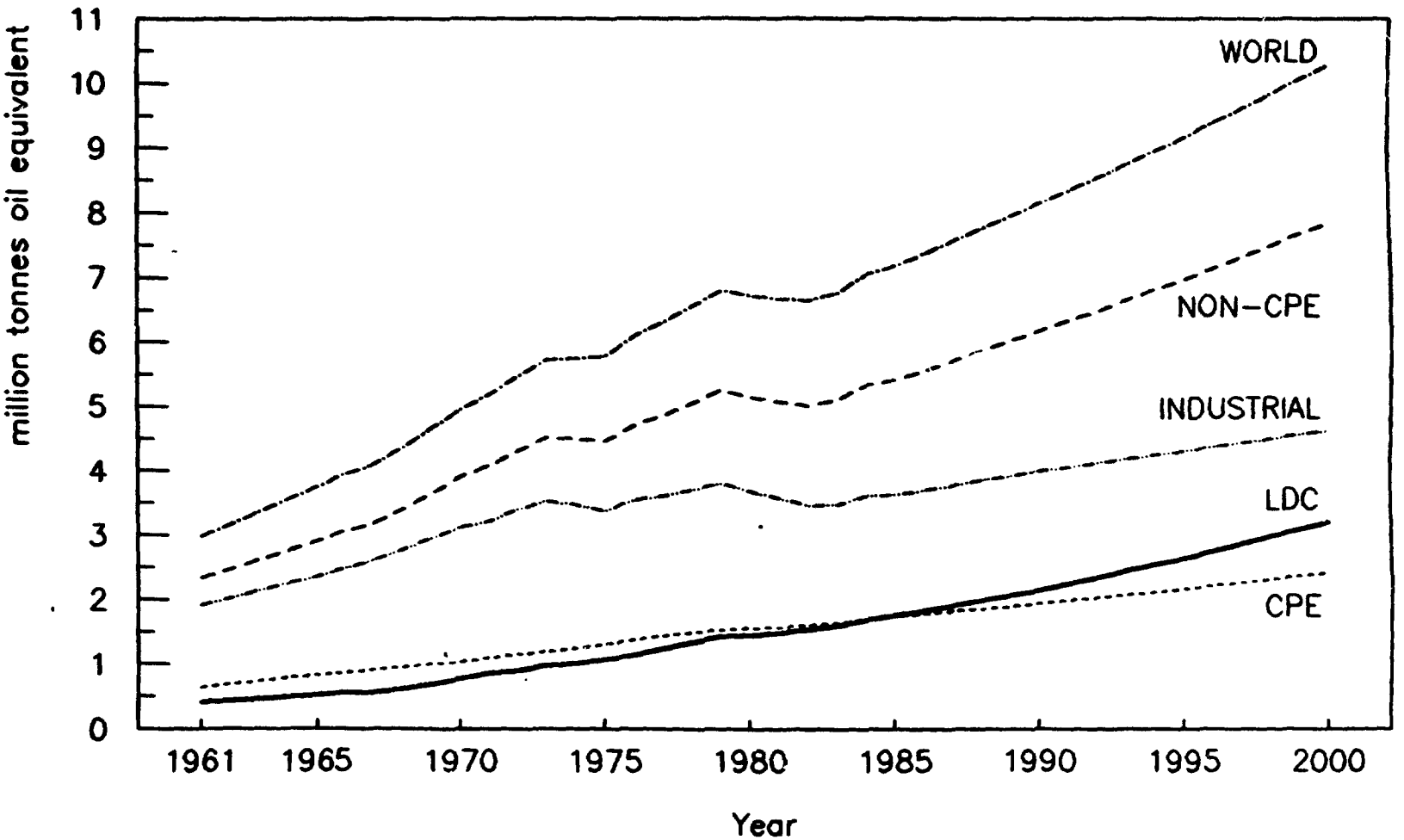


Figure 5

ENERGY vs. OIL CONSUMPTION
TOTAL WORLD AND LDC

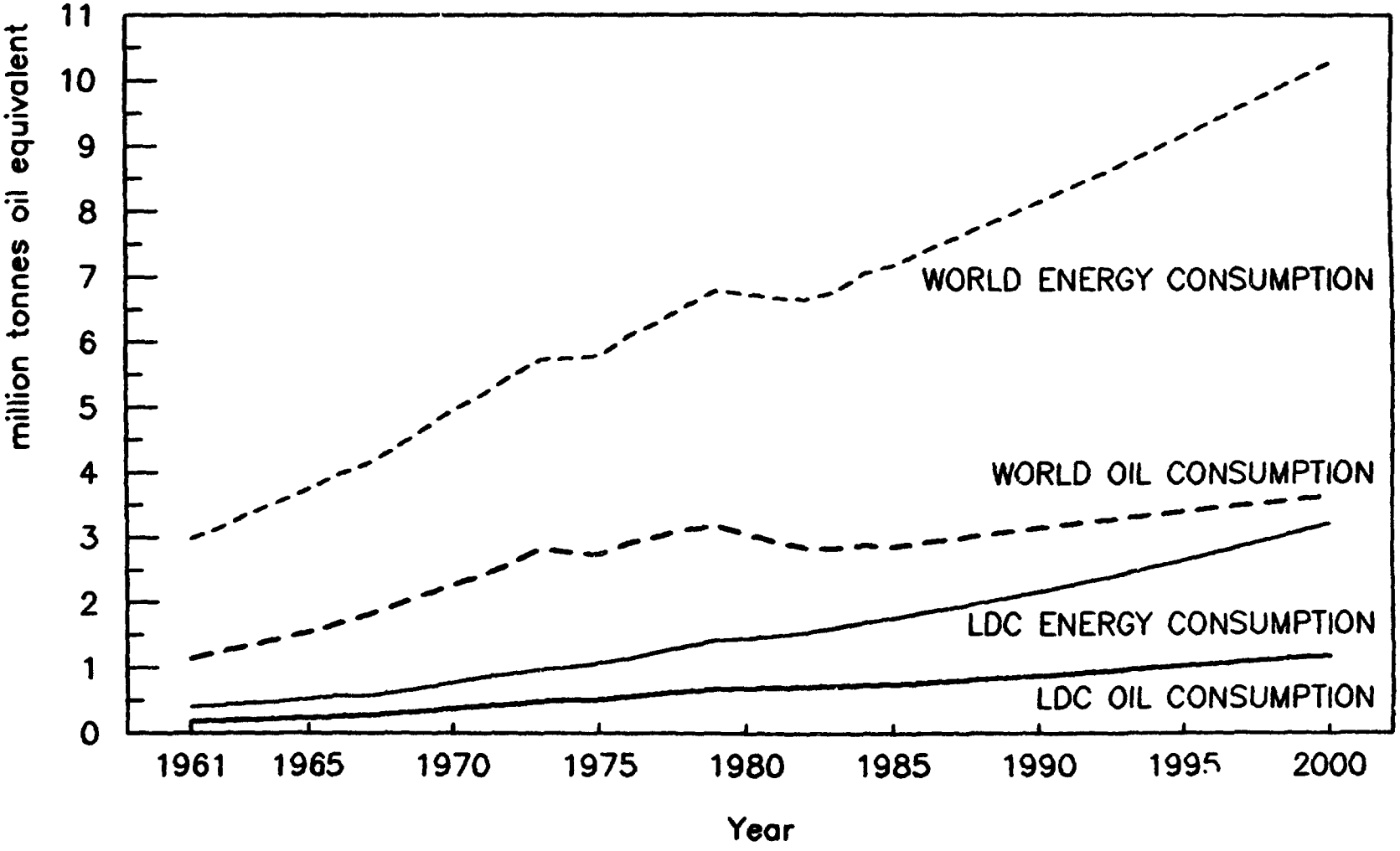


Figure 6

OIL AS A PERCENTAGE OF ENERGY CONSUMPTION
TOTAL WORLD vs. LDC

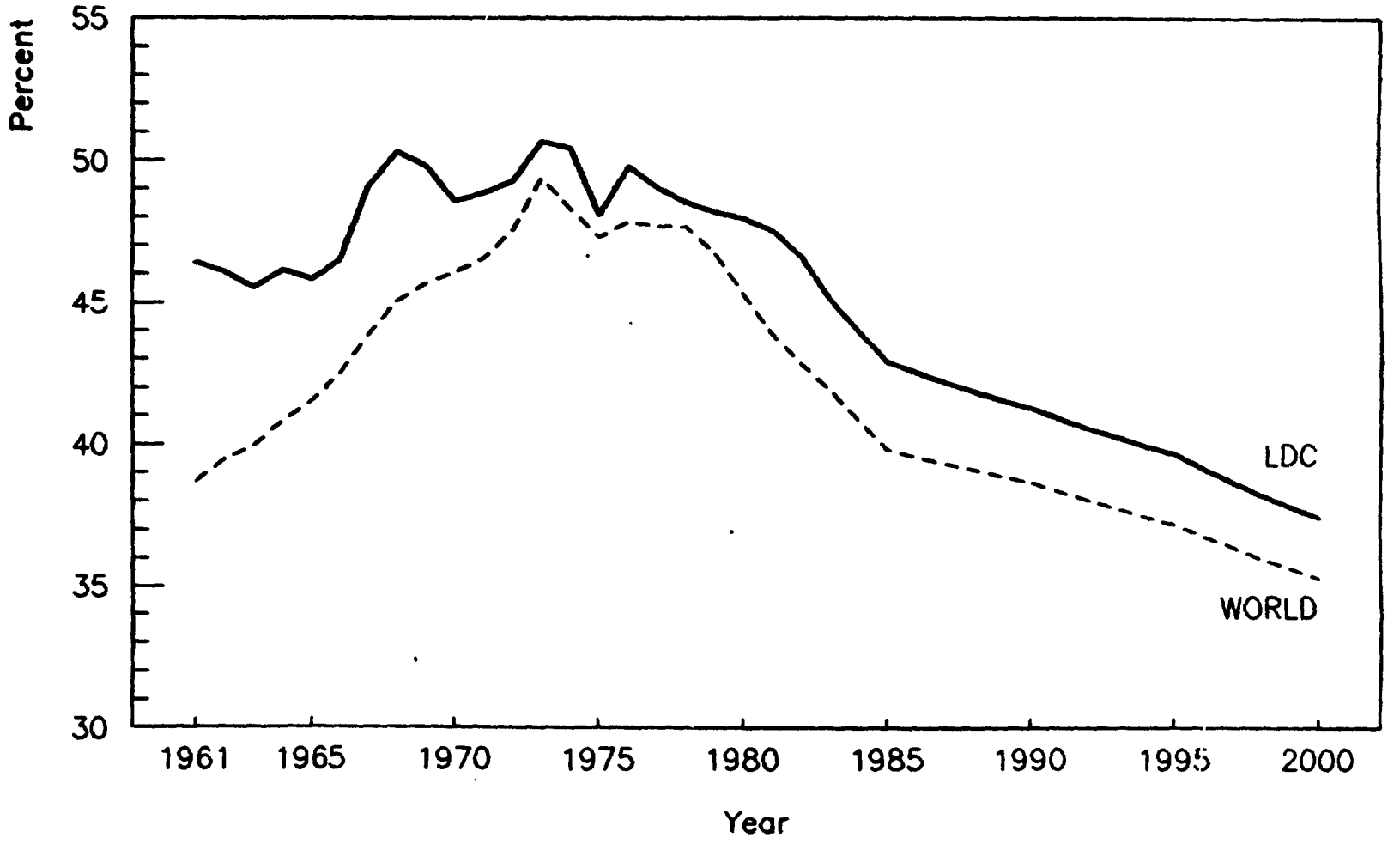


Figure 7

V. OIL CONSUMPTION FORECAST AND EXTRAPOLATION

This section illustrates the future of oil consumption. It should be emphasized that these figures portray trends which do not reflect the cycles in oil consumption nor do they attempt to pinpoint the actual consumption in any given particular year. The purpose of these forecasts is not to determine absolute numbers, but to provide a sense as to the direction of oil consumption growth, where the markets will be in the future.

Part A: Oil Consumption Until the Year 2000, portrays trends based on forecasts by the International Economics Department of the World Bank.

Part B: Oil Consumption Until the Year 2010, carries these oil consumption projections forward to the year 2010. The World Bank does not prepare official oil consumption forecasts beyond the year 2000; this section therefore extropolates linearly from the year 2000 to 2010, assuming the factors affecting growth from 1990 to 2000 will remain constant until 2010.

A. Oil Consumption Until the Year 2000

Oil consumption in developing countries is forecasted to increase by approximately 57% between 1985 and the year 2000 (Figure 8), growing from 15 mmb/d to 24 mmb/d (Figure 9). By contrast, industrial countries' oil consumption is expected to increase by 19%, only from 31 mmb/d to 36 mmb/d. Hence, total oil consumption of noncentrally-planned economies is estimated to increase by 31% from 47 mmb/d to 61 mmb/d. For the same period, consumption of centrally-planned economies will have the lowest growth of 7%, from 11 mmb/d to 11. 6 mmb/d, which decreases total world oil consumption to a growth of 27%, from 57 mmb/d to 73 mmb/d.

In terms of the percentage share of total world oil consumption, as illustrated in Figures 10 and 11, the developing countries' share of world consumption in this same period will increase from 27% to 33%. This growth in LDC oil consumption offsets the decline by other country groups. Industrial countries' share of world oil consumption is expected to decrease by 4%, from 55% to 51%, and noncentrally-planned economies will drop 3%, from 19% to 16%.

PERCENTAGE INCREASE OF OIL CONSUMPTION
1985–2000 FORECAST

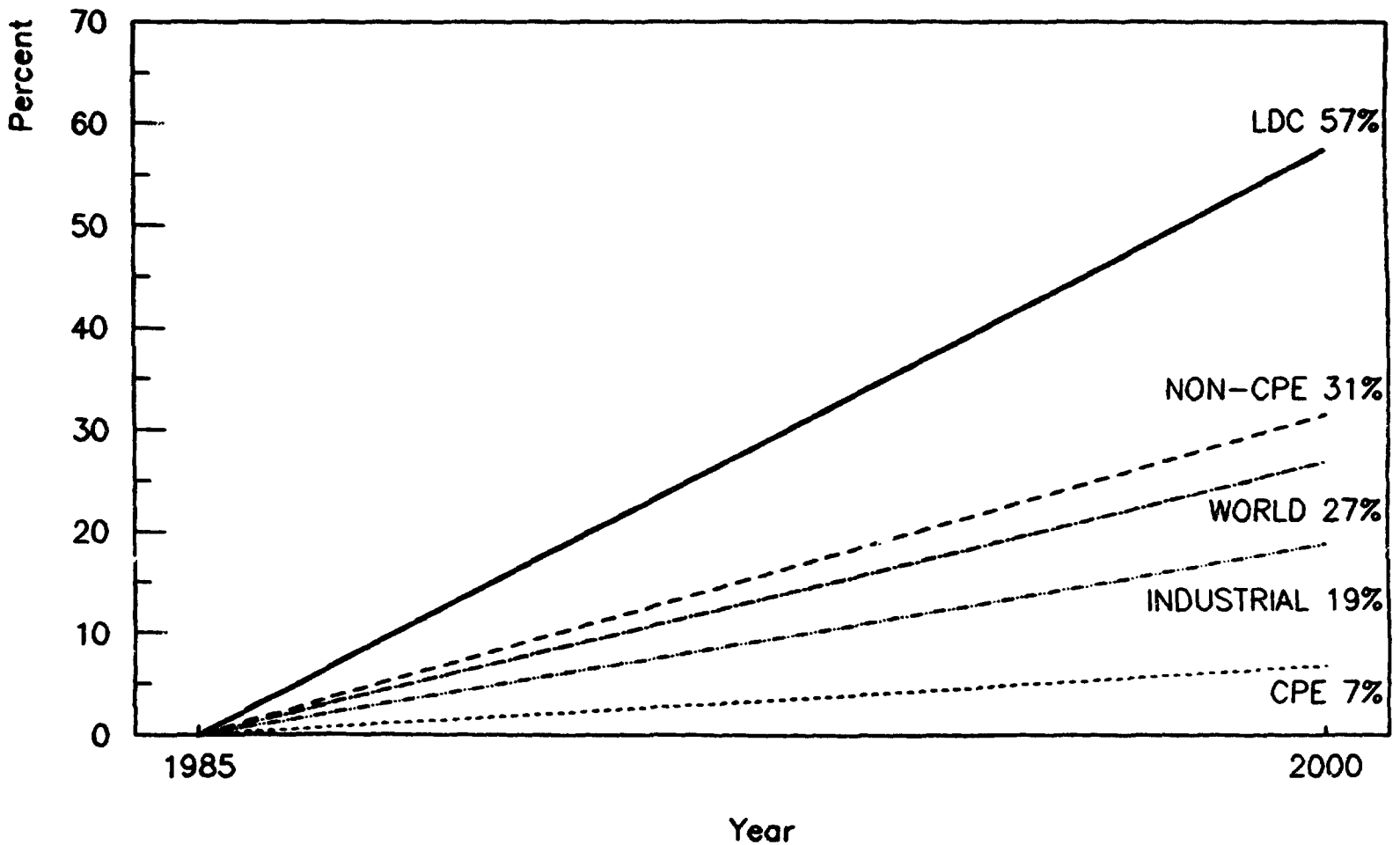


Figure 8

OIL CONSUMPTION FORECAST
1985–2000

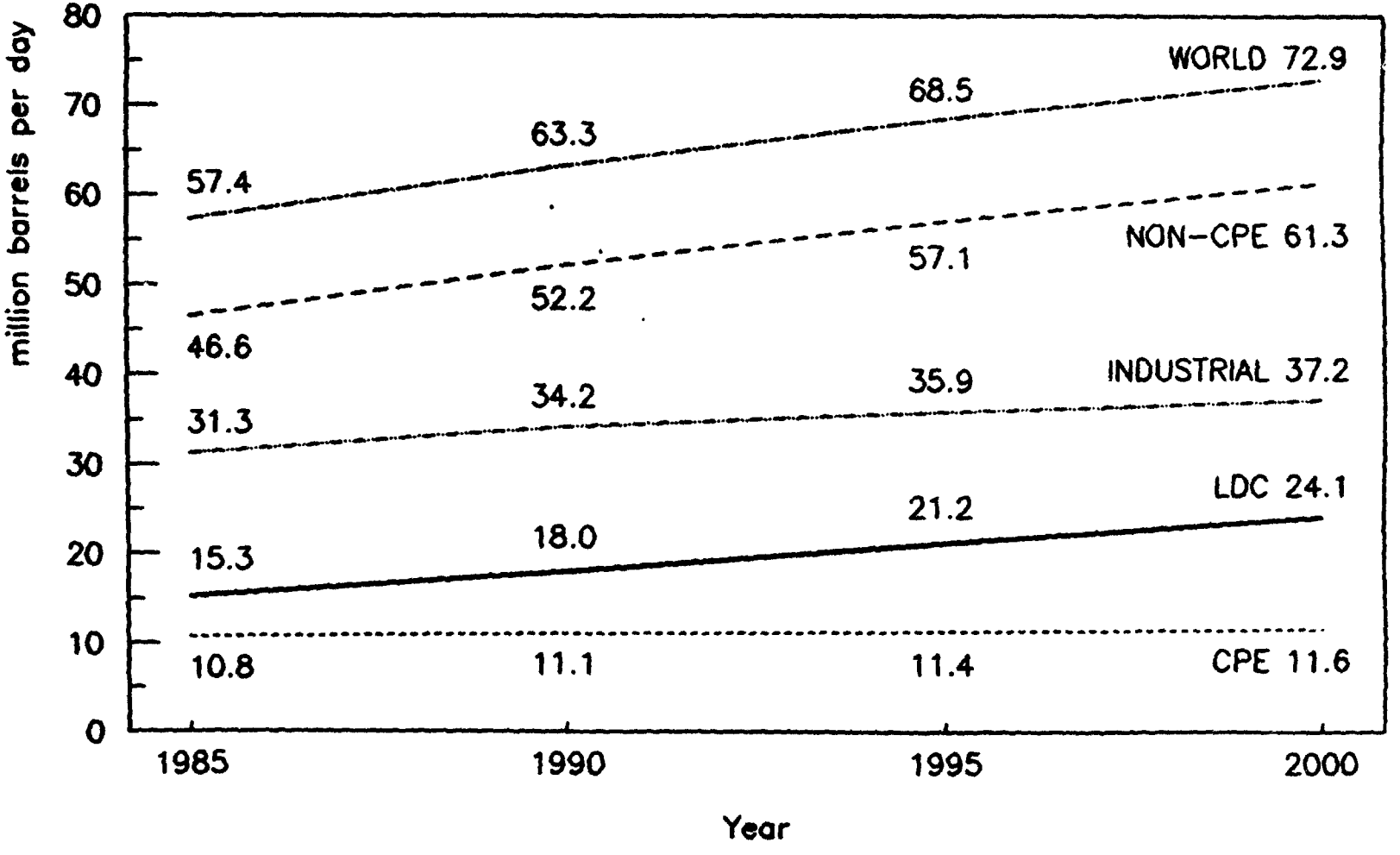


Figure 6

WORLD OIL CONSUMPTION
1961–2000

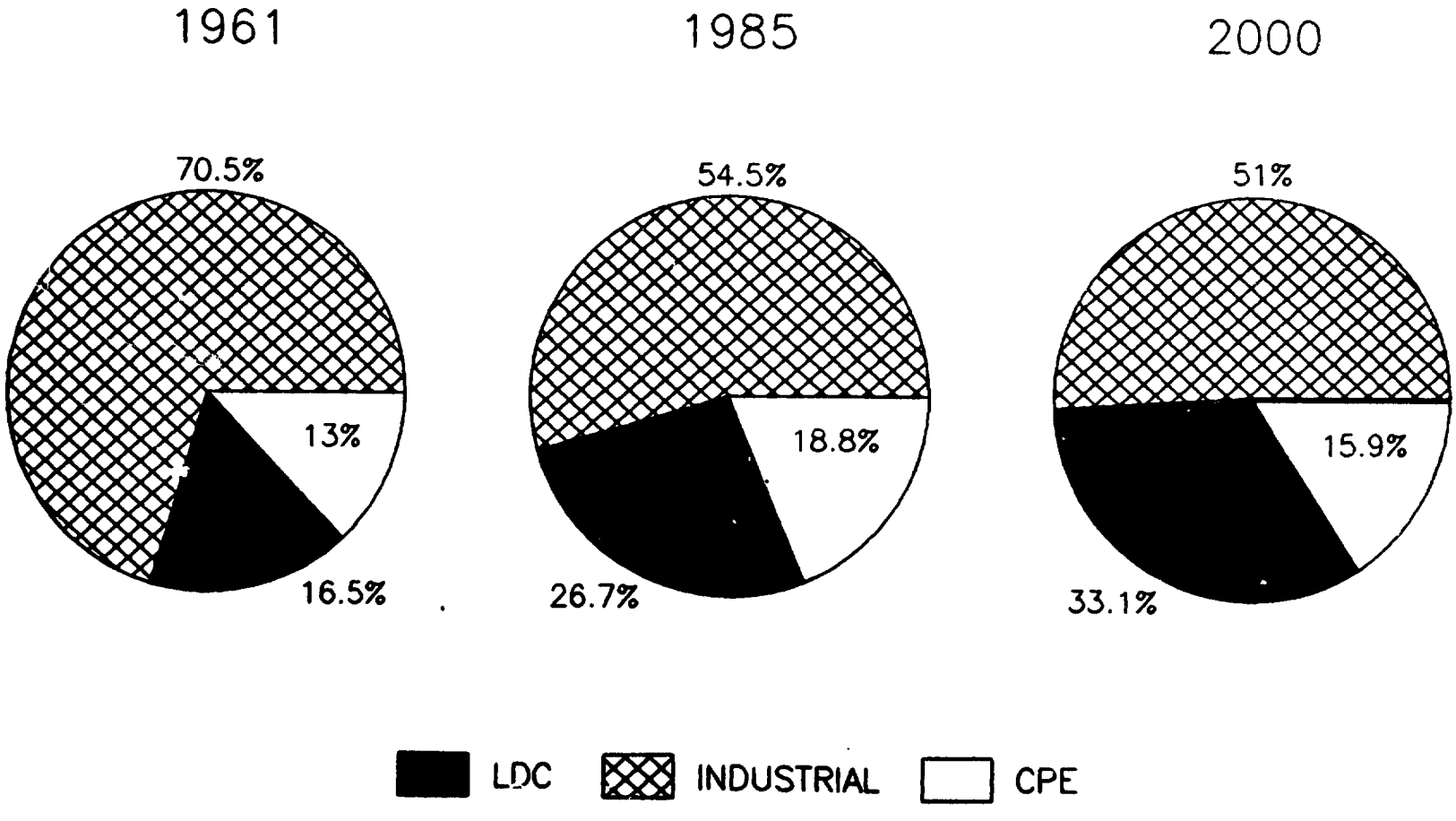


Figure 10

LDC, CPE, NON-CPE, & INDUSTRIAL COUNTRIES AS A PERCENTAGE OF WORLD OIL CONSUMPTION

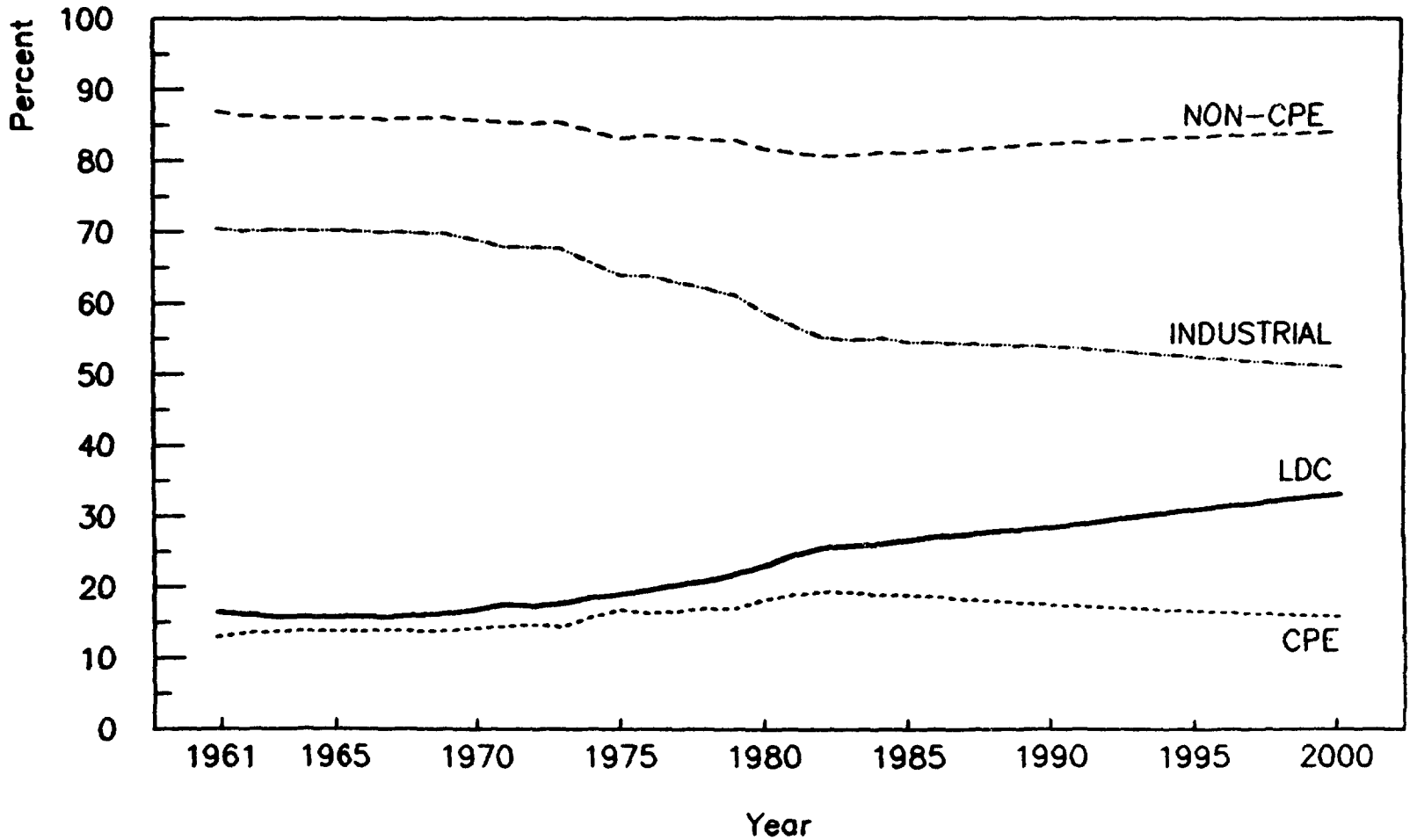


Figure 11

B. Oil Consumption Until the Year 2010

This section extends the forecast from the year 2000 to 2010. Since no attempt has been made by the Bank and most outside organizations to forecast oil consumption beyond the year 2000, our forecast to 2010 is based on a linear extropolation which assumes that the factors affecting growth from 1990 onward will remain to be constant until 2010.

Oil consumption in developing countries is forecasted to increase by approximately 103% between 1985 and the year 2010 (Figure 12), growing from 15 mmb/d to 31 mmb/d (Figure 13). By contrast, industrial countries' oil consumption is expected to increase by 28% from 31 mmb/d to 40 mmb/d. Hence, total oil consumption of noncentrally-planned economies is estimated to increase by 53% from 47 mmb/d to 71 mmb/d. For the same period, consumption of centrally-planned economies will have the lowest growth of 10%, from 11 mmb/d to 12 mmb/d, which decreases total world oil consumption to a growth of 45%, from 57 mmb/d to 83 mmb/d/.

In terms of the percentage share of total world oil consumption, as illustrated in Figures 14 and 15, the developing countries' share of world consumption in this same period will increase by 11%, from 27% to 38%. Such rapid growth in LDC oil consumption offsets decline in other country groups. Industrial countries' share of world oil consumption is expected to decrease by 7%, from 55% to 48%, and noncentrally-planned economies', by 5%, from 19% to 14%.

PERCENTAGE INCREASE OF OIL CONSUMPTION
1985-2010 FORECAST

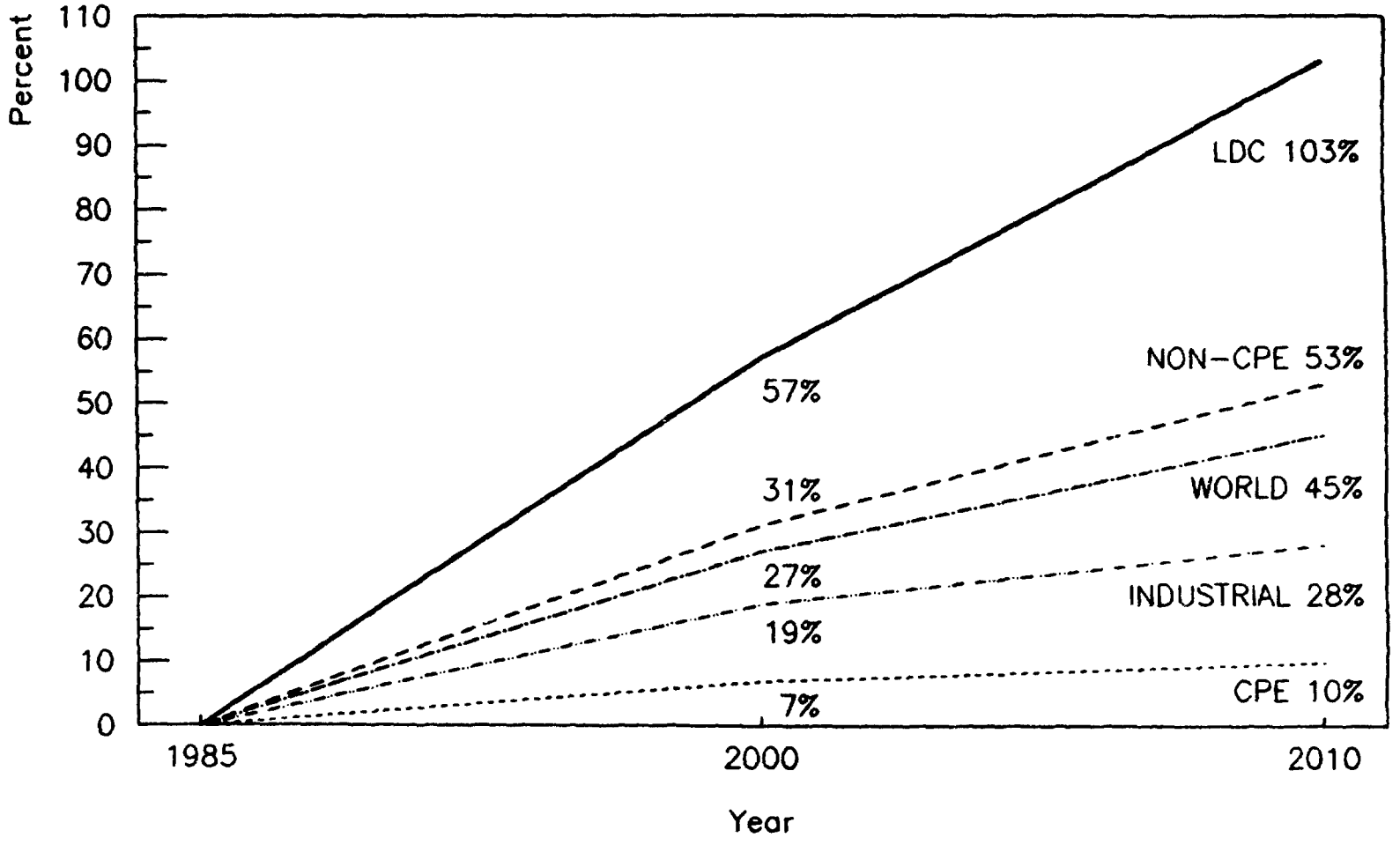


Figure 12

OIL CONSUMPTION FORECAST
1985–2010

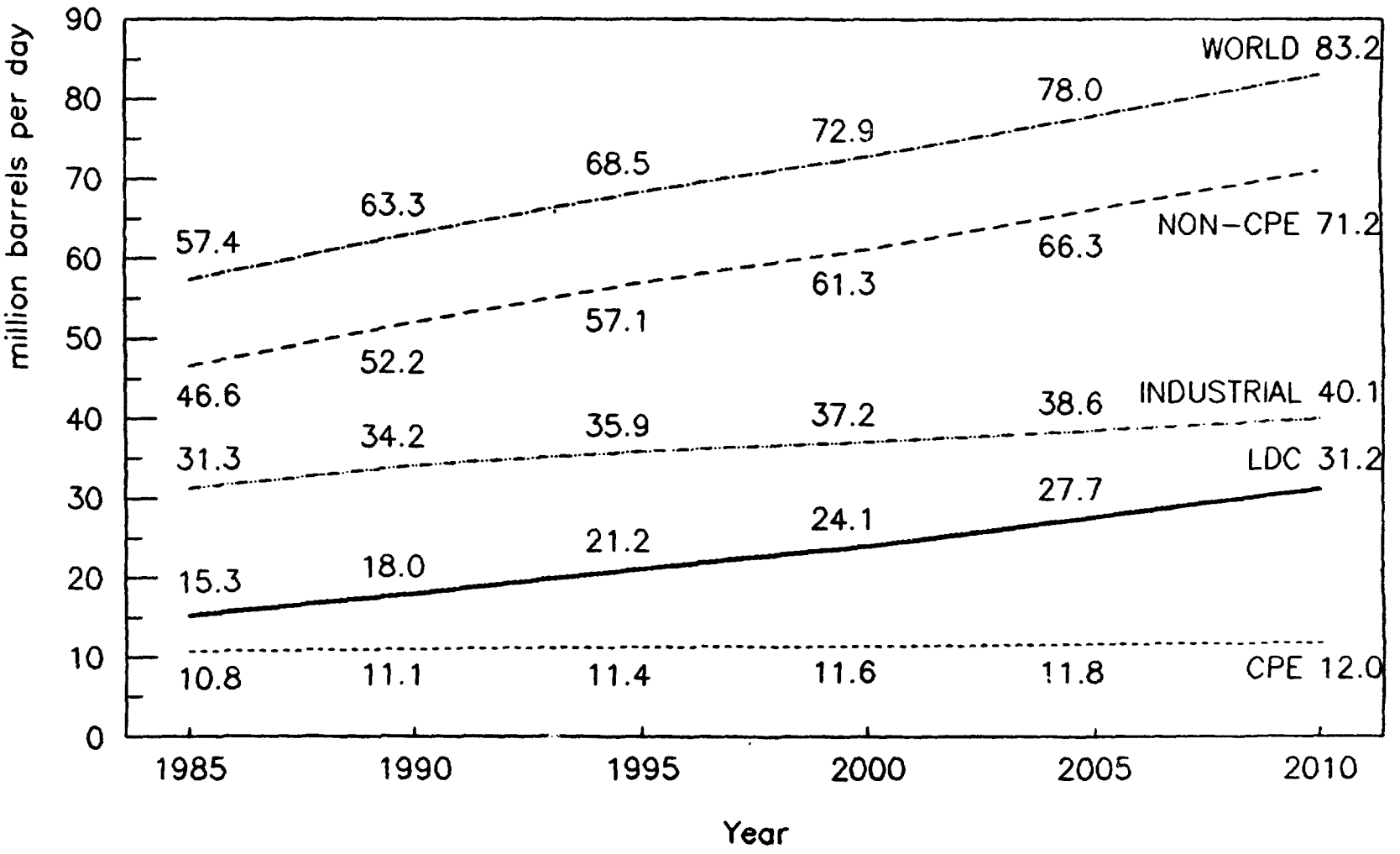


Figure 13

WORLD OIL CONSUMPTION
1985–2010

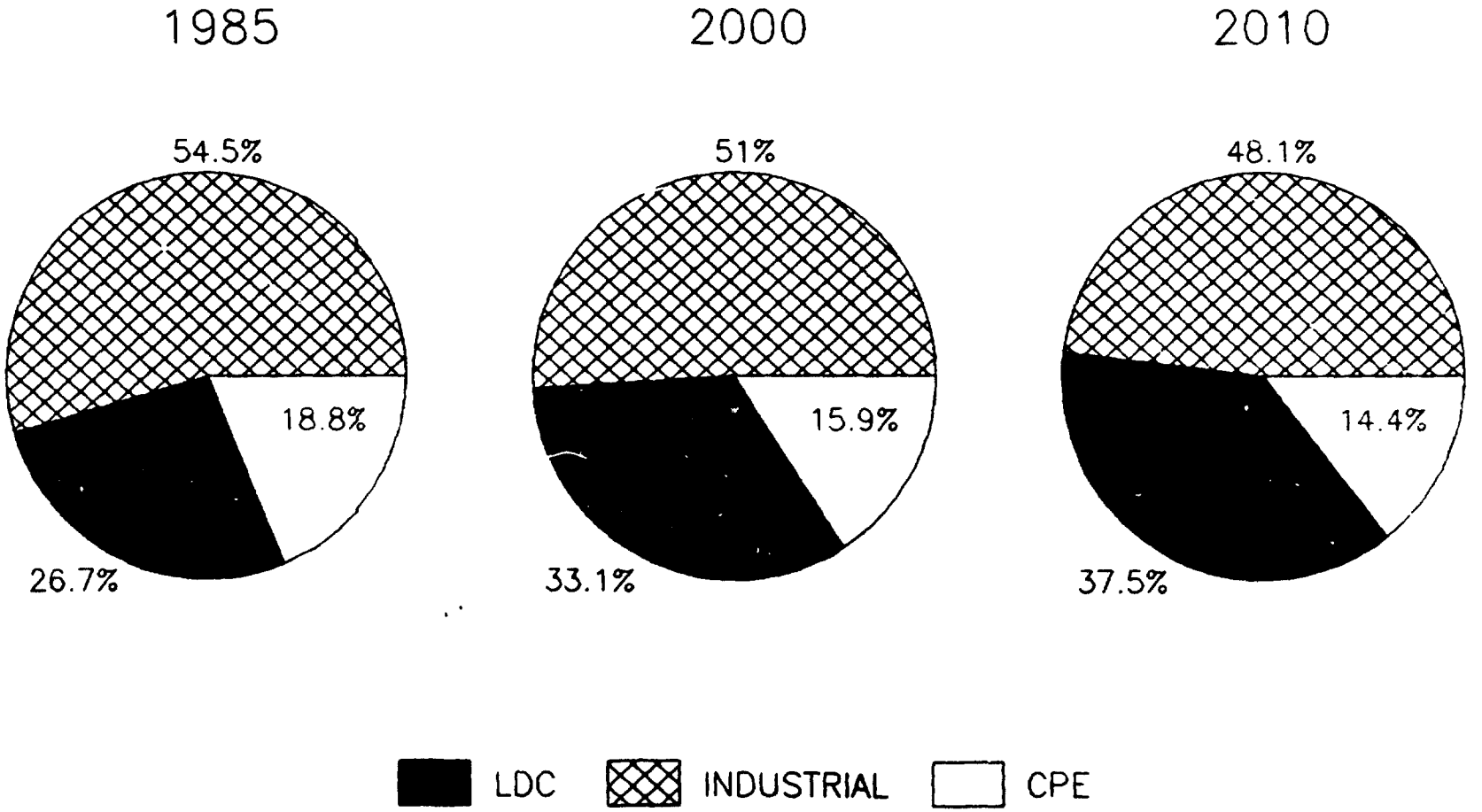


Figure 14

LDC, CPE, NON-CPE, & INDUSTRIALIZED COUNTRIES AS A PERCENTAGE OF WORLD OIL CONSUMPTION

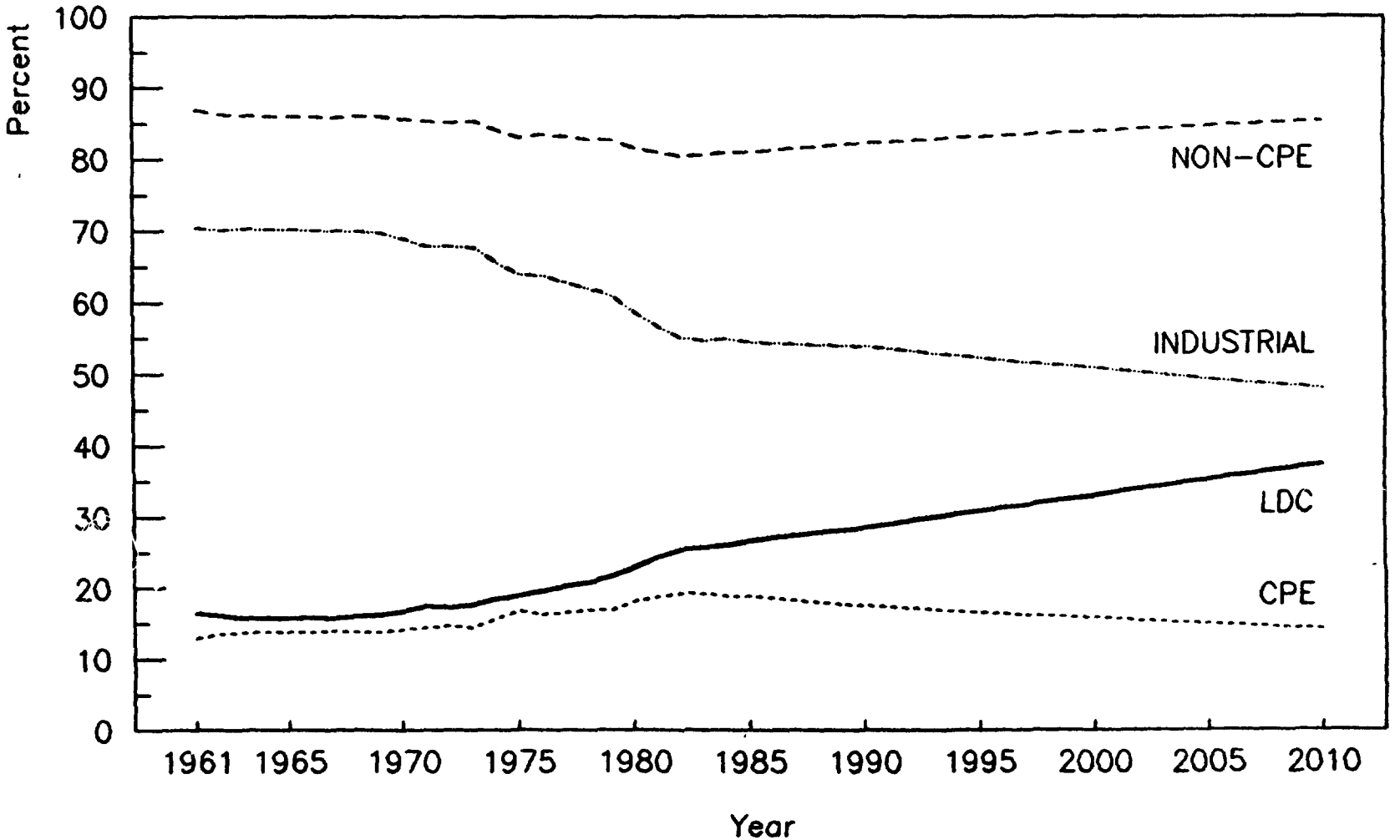


Figure 15

VI. OIL CONSUMPTION BY SECTOR

Traditionally, oil consumption has been dependent mainly on prevailing oil prices, the economic health of individual countries and the world, and population. However, after the oil crisis in the early 1970s, breakthroughs and transfers of technology have allowed various sectors within a country to increase efficiency in the use of oil and, on the other side of the spectrum, to convert to alternative energy sources.

For this study, oil consumption is allocated into three major sectors: industry, transport and other (residential and commercial). It is in the industrial sector, including electric power and industrial applications, where conversion to coal and natural gas is expected to take place and where nuclear could play a role. There could be some but very limited conversion to alternative fuels in the transport sector. Obviously, the degree of conversion and increased strides in efficiency and conservation will depend on price. These possibilities for oil substitution will have an impact on refinery policies, namely the need to upgrade refineries to produce lighter transportation fuels.

There are no official sources, including the Bank, that allocate crude oil consumption by sector on a worldwide basis. For purposes of this study, assumptions have been made based on the readily available oil product statistics for OECD countries and statistics available on selected developing countries. Sectoral allocations are based on consumption statistics by oil products. The assumptions for fuel allocation by sector are as follows:

LPG	- 31.5% Transport, 31.5% Industry, 37% Other
Aviation Gas	- 100% Transport
Gasoline	- 100% Transport
Kerosene	- 14% Industry, 86% Other
Jet Fuel	- 100% Transport
Diesel	- 45% Transport, 20% Industry, 35% Other
Residual	- 100% Industry
Naptha	- 100% Industry
Refinery Gas	- 100% Industry
Secondary Products	- 100% Industry

This section has been cross-referenced into four parts:

Part A - Oil Consumption by Sector 1970-1986
Part B - Oil Consumption by Sector Country Groups
Part C - Oil Consumption in the Industrial Sector
Part D - Oil Consumption in the Transportation Sector

A. Oil Consumption by Sector 1970 - 1986

Figure 16 summarizes the breakdown by sector of oil consumption as a percentage of total consumption as well as the changes in these percentages over the sixteen years from 1970 to 1986. Total world averages, composed of industrial countries, LDCs and CPEs, indicate that, although the industrial sector remained dominant in oil consumption during the sixteen-year period, its share decreased by 6%, from 52% in 1970 to 46% in 1986. Such decrease reflects the worldwide trend in energy conservation, efficiency improvements and conversion to other energy sources. Increases in the transport and other sectors reflect, to a degree, increased mobility, trade and population growth.

Most of the world's decrease in oil consumption in the industrial sector can be attributed to the dramatic decrease experienced in the industrial countries where oil consumption in the industrial sector dropped by 12% during this period, from 49% to 37%. Most of the oil consumption was shifted to the transport sector, which increased by 10% from 40% to 50% during the same period. Aside from the factors which caused the decrease in the share of industrial sector oil consumption worldwide, the drop in the industrial countries may be attributed to the "de-industrialization" phenomenon, i.e., the move towards a service sector and information-oriented economy coupled with the transferring of manufacturing processes through multinational corporations to lower-cost LDCs.

Thus, contrary to expectations that transport is the dominant oil-consuming sector in LDCs, the "industrialization" of LDCs, coupled generally with the existence of older and less-efficient plants, have caused their industry sector to be the most oil-intensive. However, due to conservation and efficiency improvements, the industry sector's share of oil consumption has dropped by 5% during the sixteen-year period, from 60% to 55%. Nevertheless, the magnitude of oil consumption in the industrial sector indicates the extent to which conversion to other fuels can mitigate its share of total oil consumption. In addition, the development of new less energy-intensive technological processes will have an effect.

OIL CONSUMPTION BY SECTOR

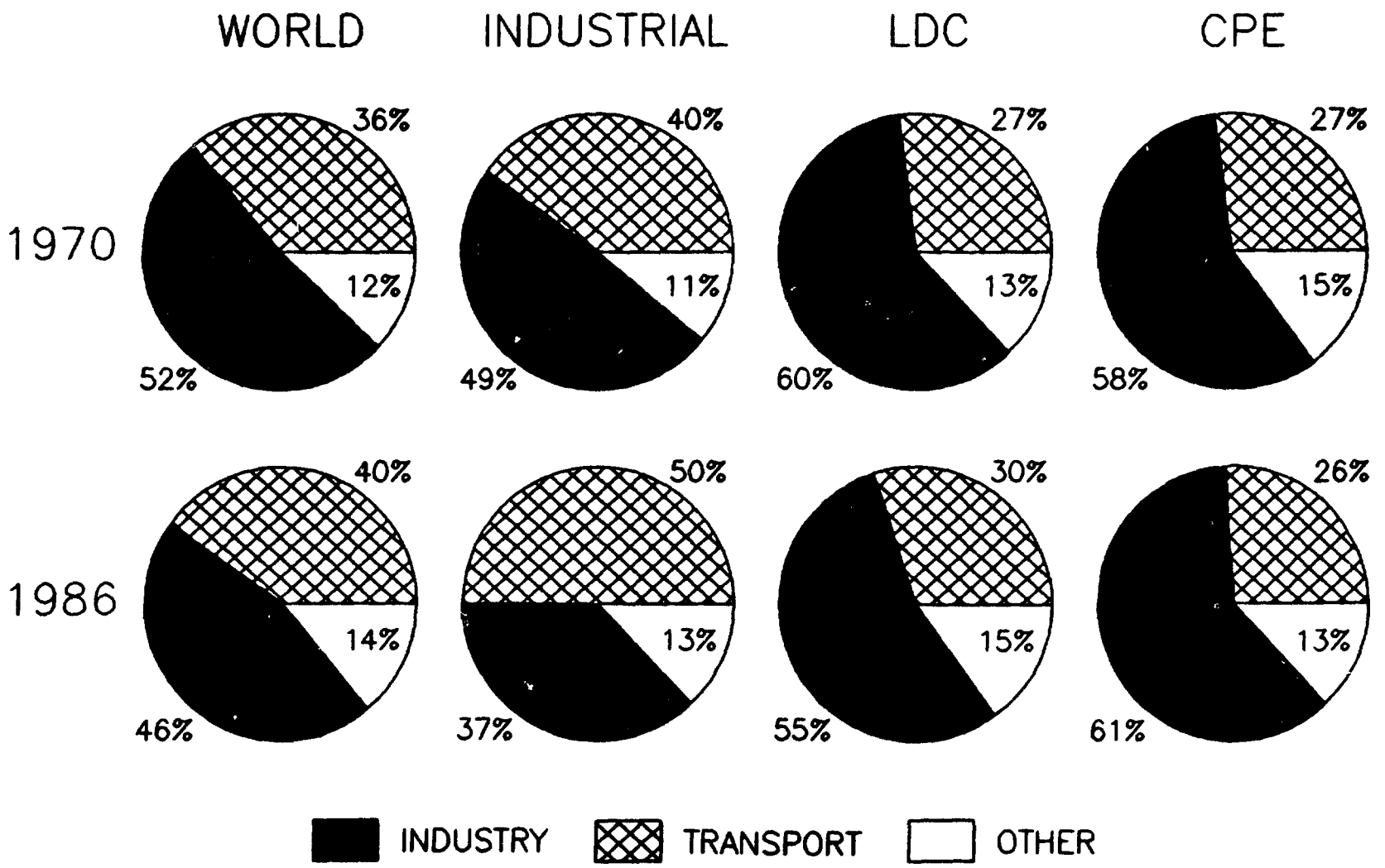


Figure 16

B. Oil Consumption by Sector - Country Groups

Figures 17-26 provide a more gradual and continuous illustration of the shifts in oil consumption across various sectors for the total world and the various country groups--LDCs, industrial countries, CPEs and NON-CPEs--in the 1970-1986 period. The Figures are presented in both millions of barrels per day and as percentages of total consumption.

Total World (Figures 17 and 18)

World oil consumption has been responsive to the price surges (Figure 17) and, in particular, industry was the most responsive. Both Transport and Other remained fairly stable. Nevertheless, Industry's share is decreasing versus an increasing trend in Transport, towards a more equal proportion between these sectors (Figure 18).

LDC (Figures 19 and 20)

Oil consumption has fluctuated in response to price changes, however, oil consumption continued to increase (Figure 19) in the developing countries. The growth in Transport and Other was more stable than in the Industry sector.

Industrial Countries (Figures 21 and 22)

Since the oil price shock in the late 70s, the industrial countries have experienced negative growth in oil consumption and the Industrial sector mirrored this pattern. With the relatively stable growth of Transport, oil consumption in the Transport sector surpassed Industry's after 1980 (Figures 21 and 22) while it has remained steady in the other sector.

Centrally Planned Economies (Figures 23 and 24)

Oil consumption of centrally planned economies remained fairly constant despite fluctuating prices (figures 23). Within this total consumption, the percentage share of the various sectors has remained unchanged as well.

Non-CPE (Figures 25 and 26)

Oil consumption of Non-CPEs including developing countries, followed closely total world oil consumption since CPEs remained relatively unaffected by price changes during the 1970-1986 period (Figure 25). However, the increase in Transport coupled with the decrease in Industry has resulted in an even split in their share of oil consumption (Figures 25 and 26).

WORLD OIL CONSUMPTION BY SECTOR
1970-1986

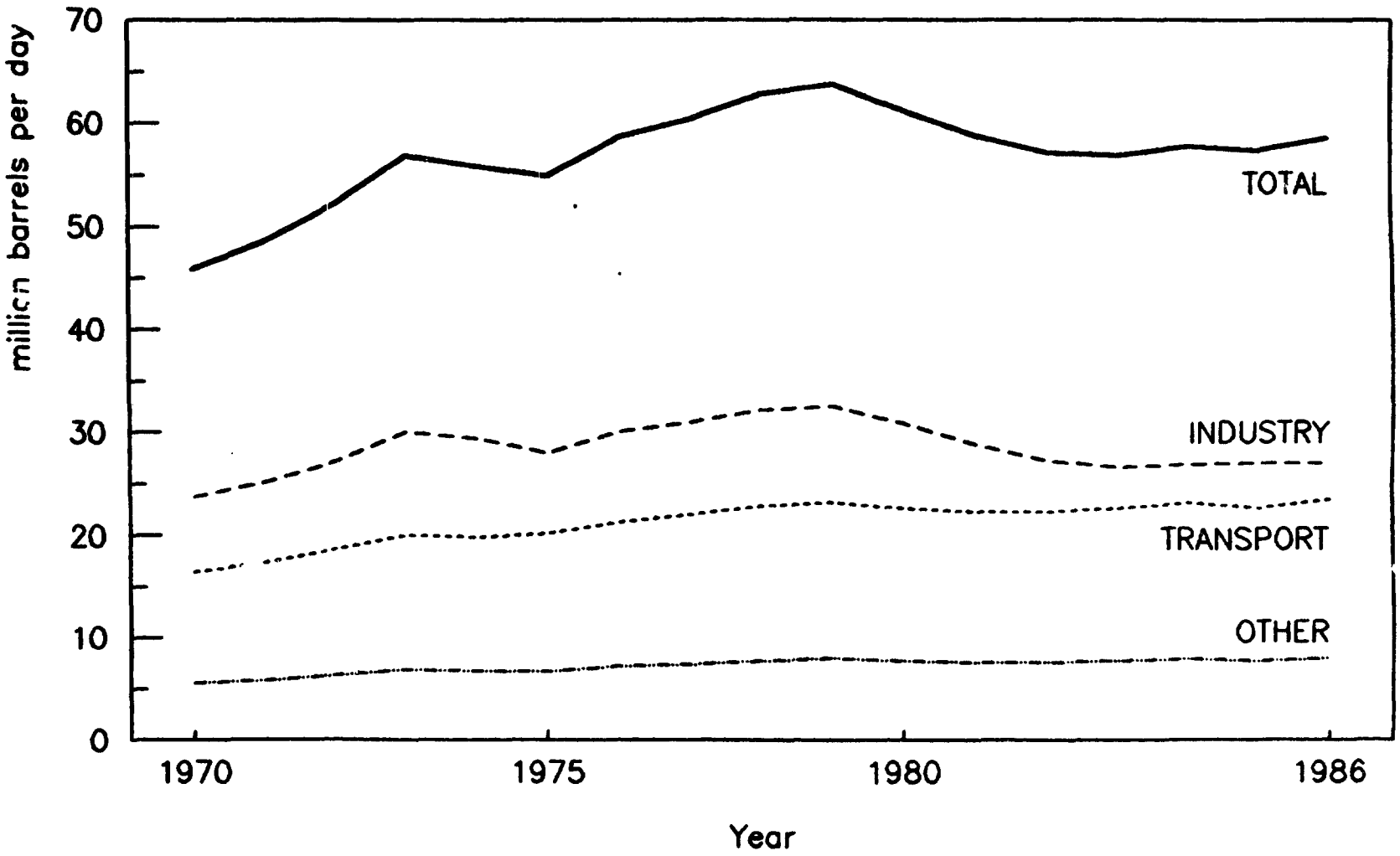


Figure 17

PERCENTAGE OF OIL CONSUMPTION BY SECTOR
TOTAL WORLD

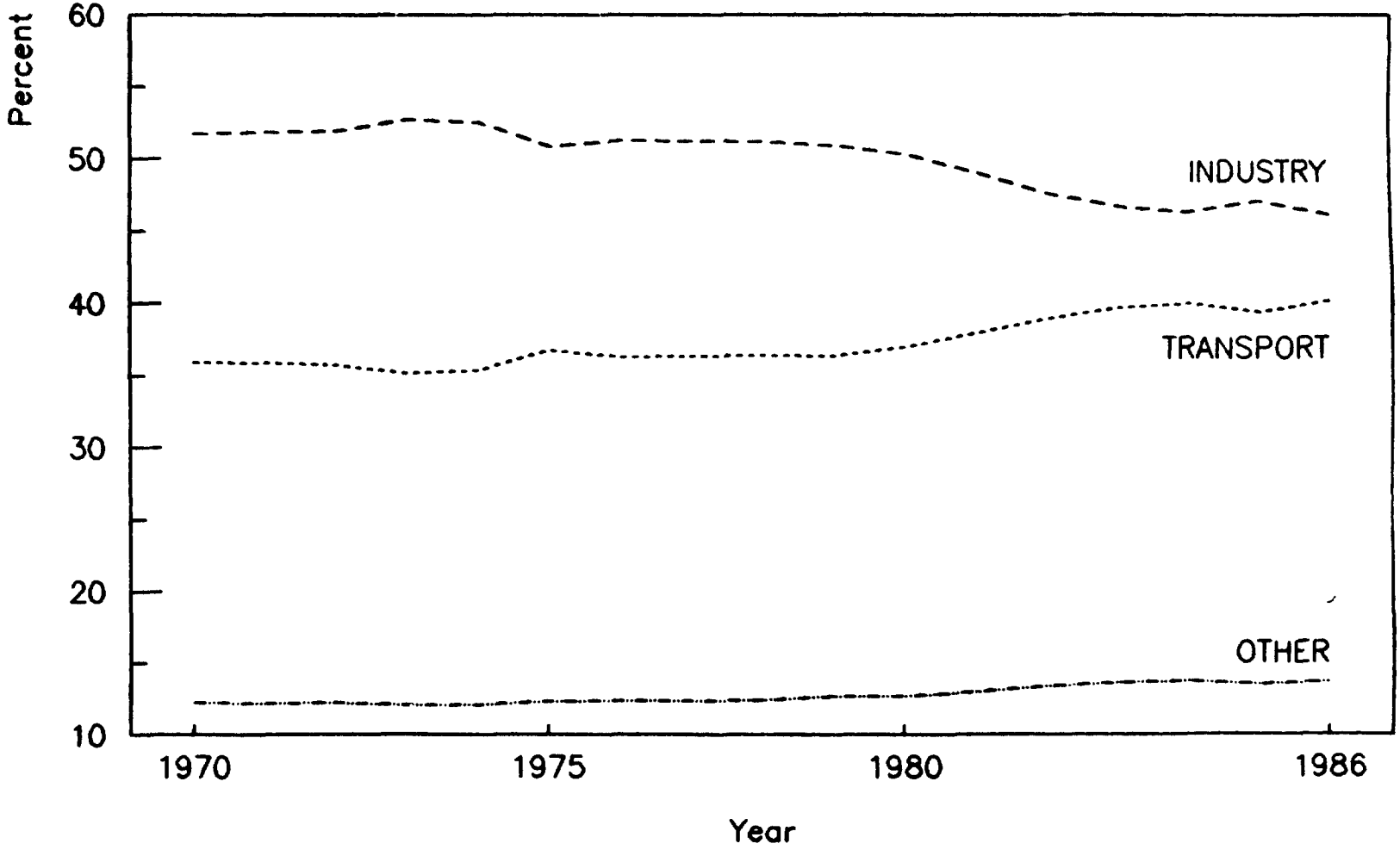


Figure 18

LDC OIL CONSUMPTION BY SECTOR
1970-1986

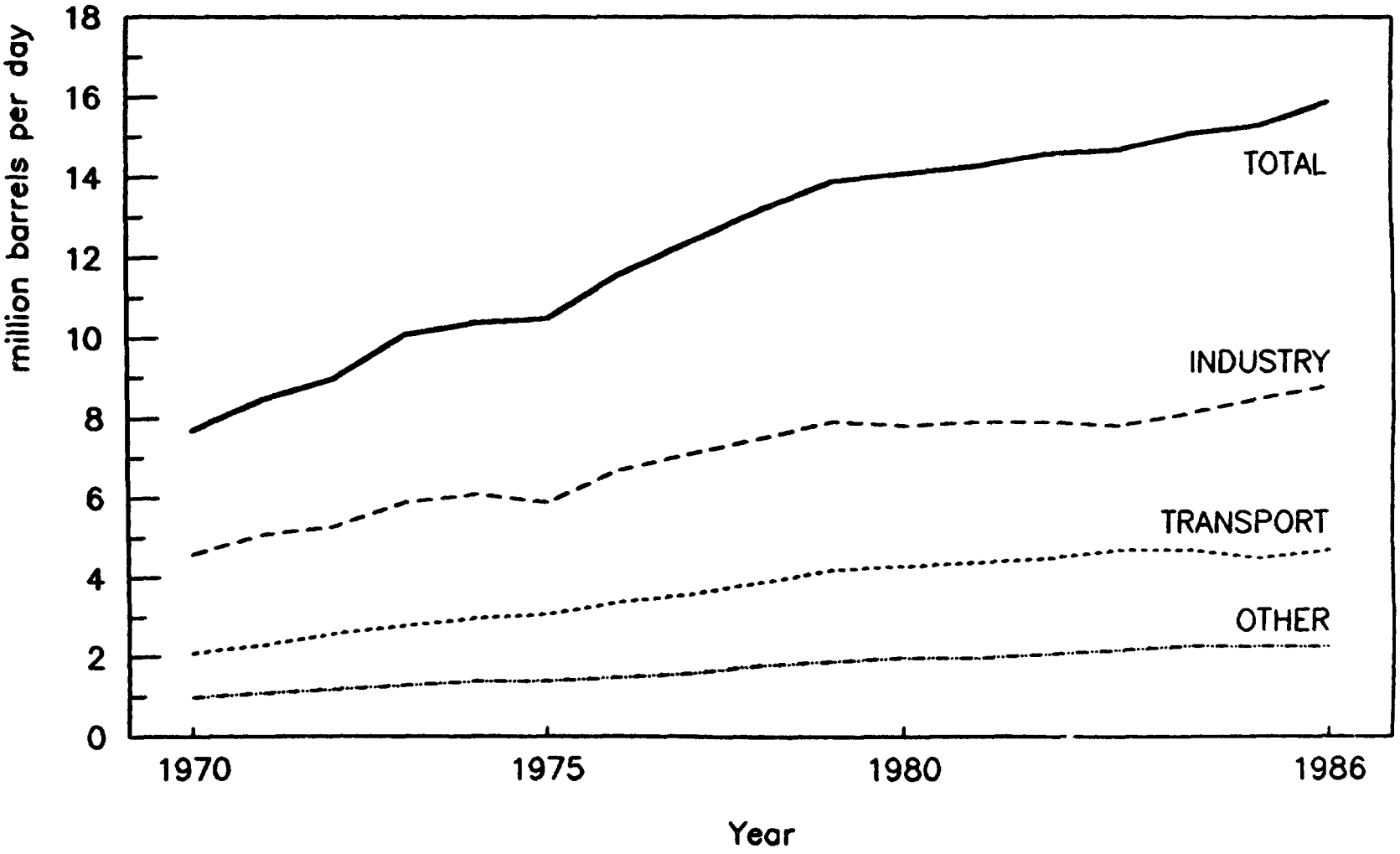


Figure 19

PERCENTAGE OF OIL CONSUMPTION BY SECTOR
LESS DEVELOPED COUNTRIES

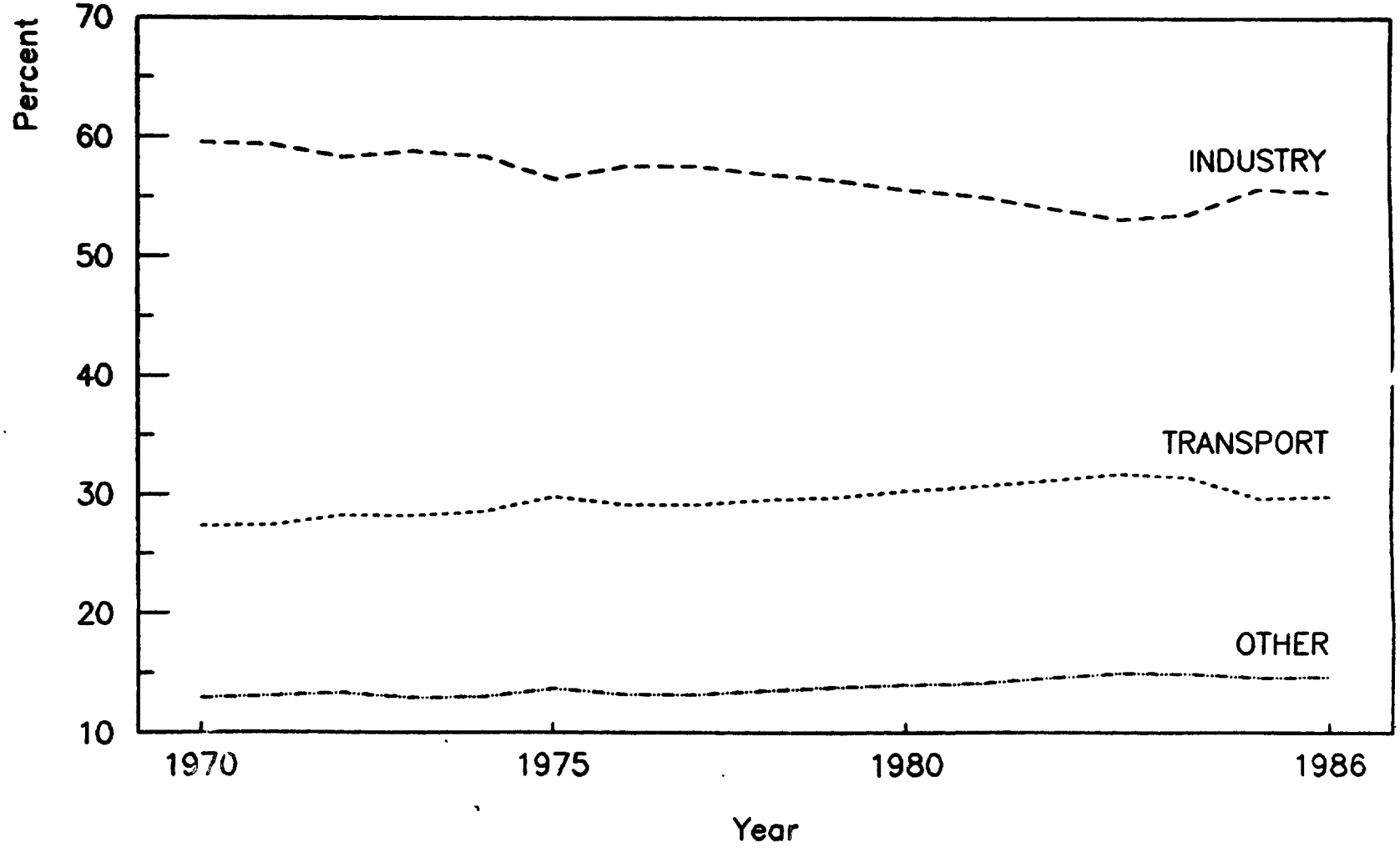


Figure 20

INDUSTRIAL COUNTRIES' OIL CONSUMPTION BY SECTOR 1970–1986

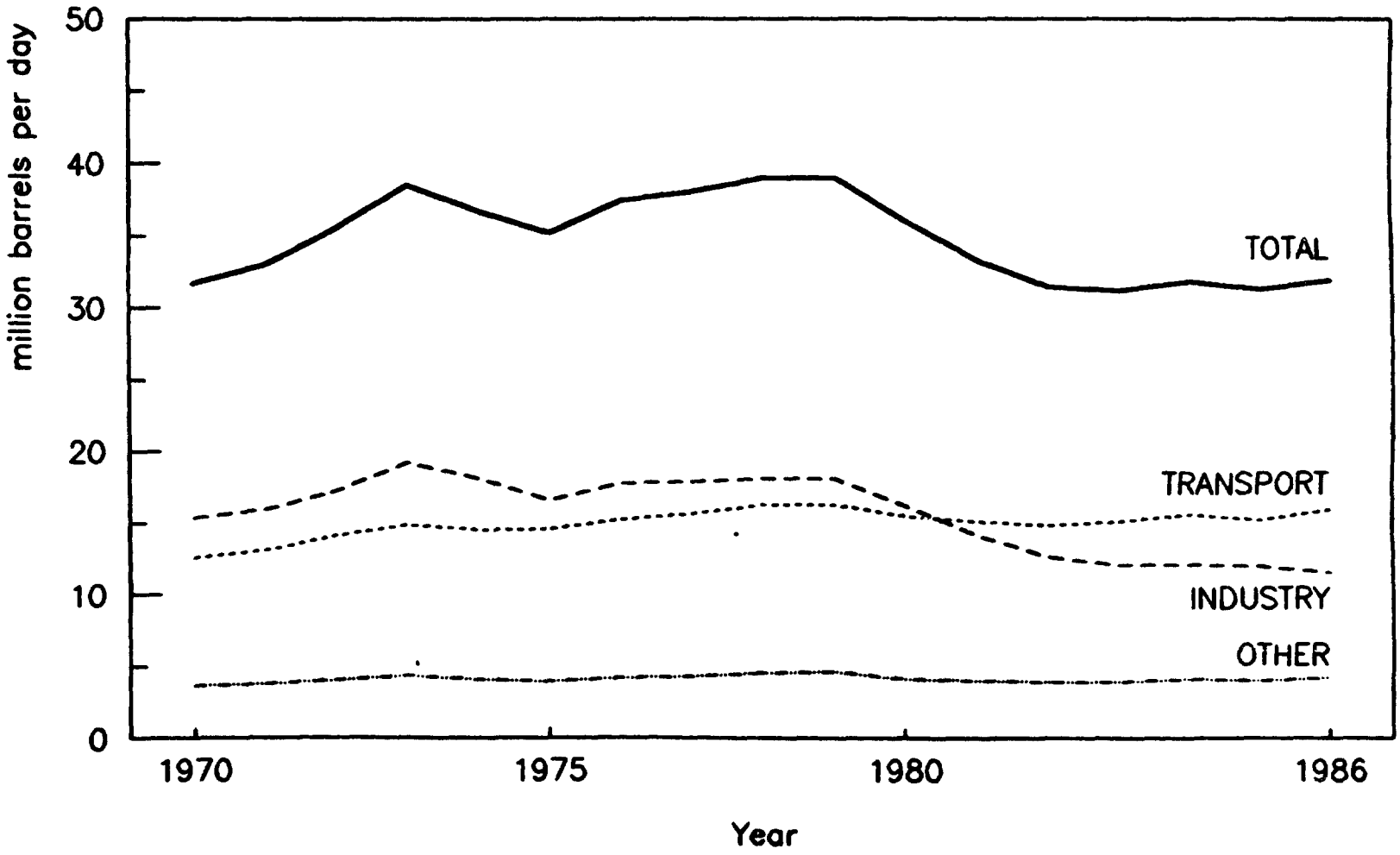


Figure 21

PERCENTAGE OF OIL CONSUMPTION BY SECTOR
INDUSTRIAL COUNTRIES

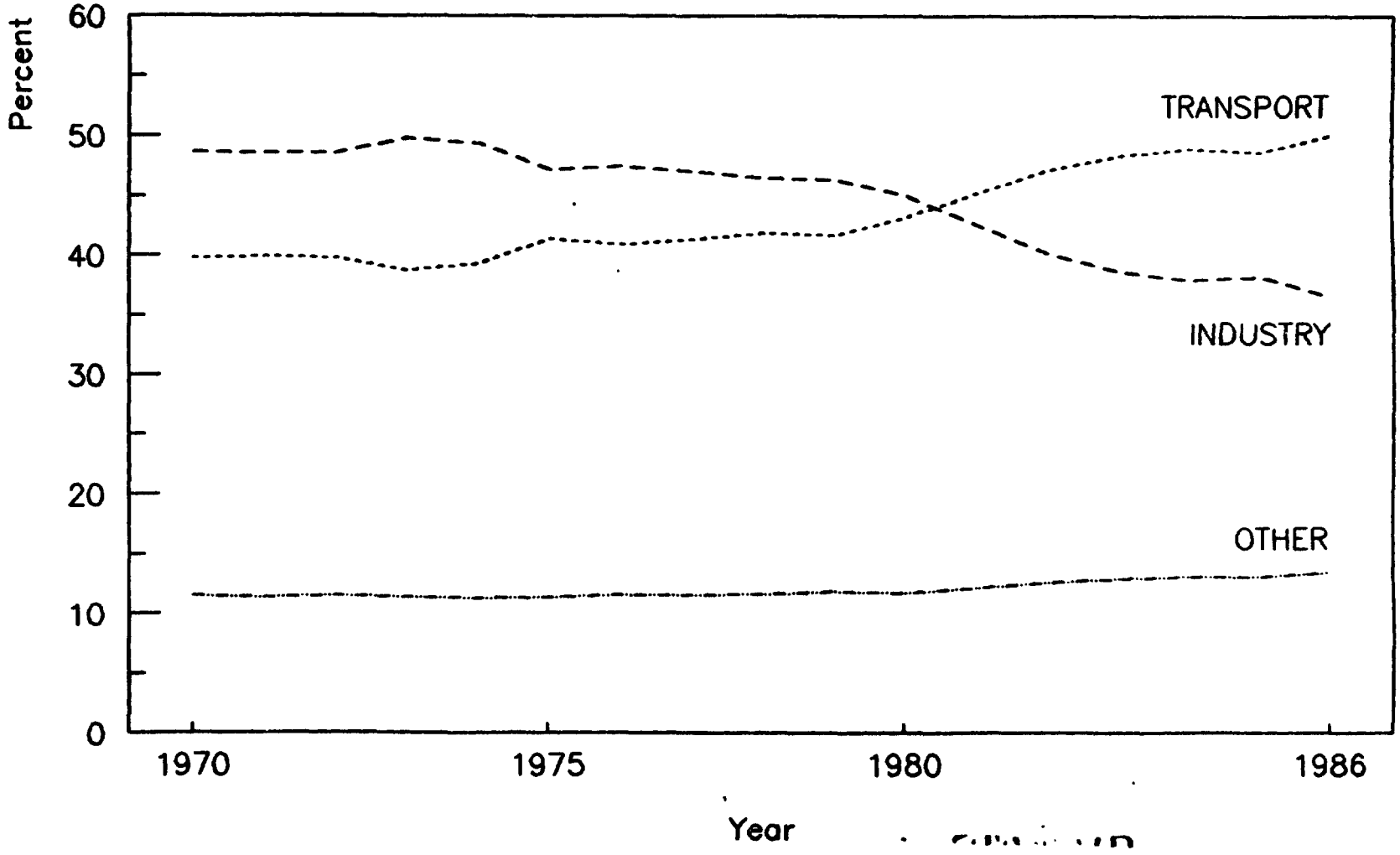


Figure 22

CPE OIL CONSUMPTION BY SECTOR
1970-1986

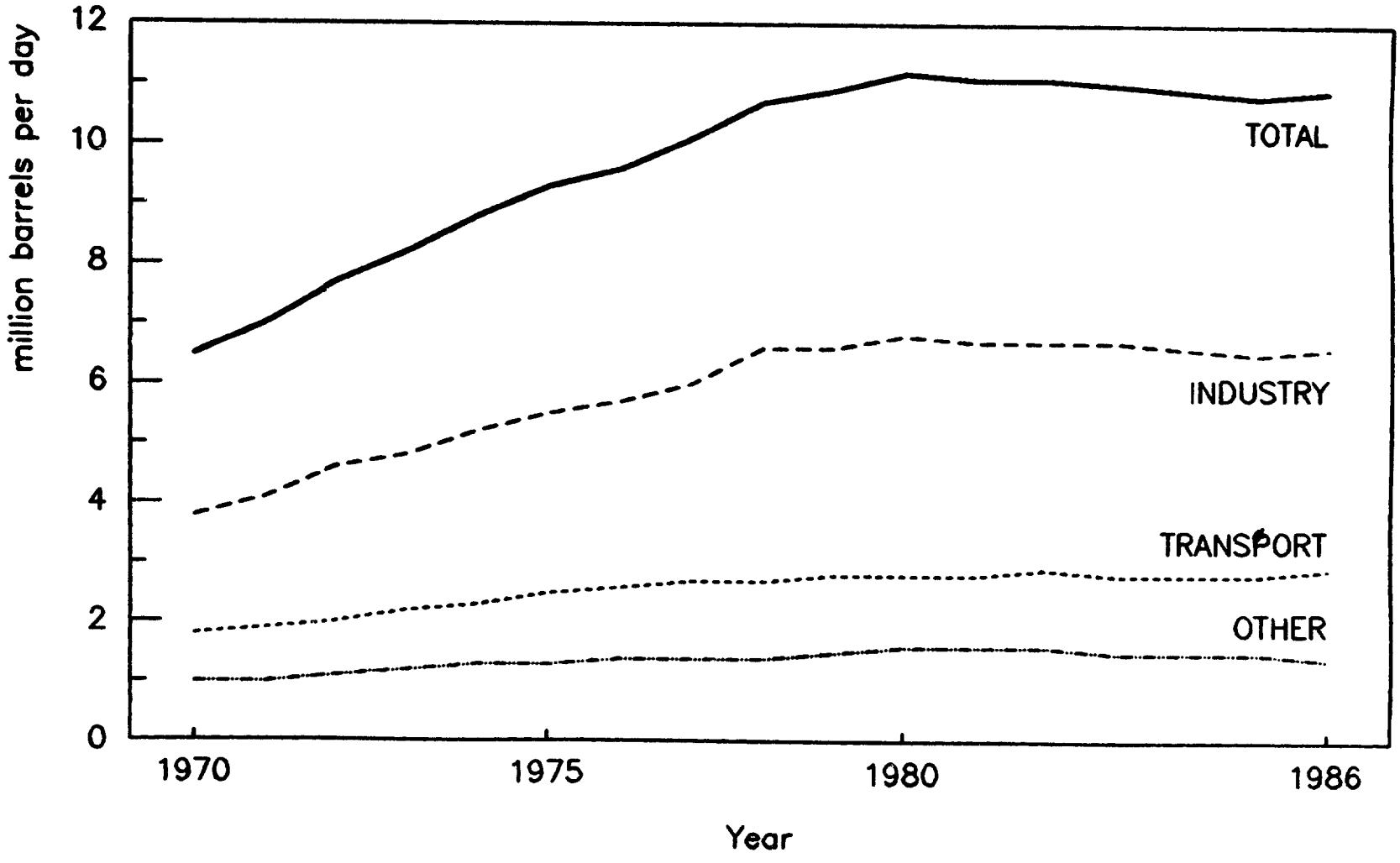


Figure 23

PERCENTAGE OF OIL CONSUMPTION BY SECTOR CENTRALLY-PLANNED ECONOMIES

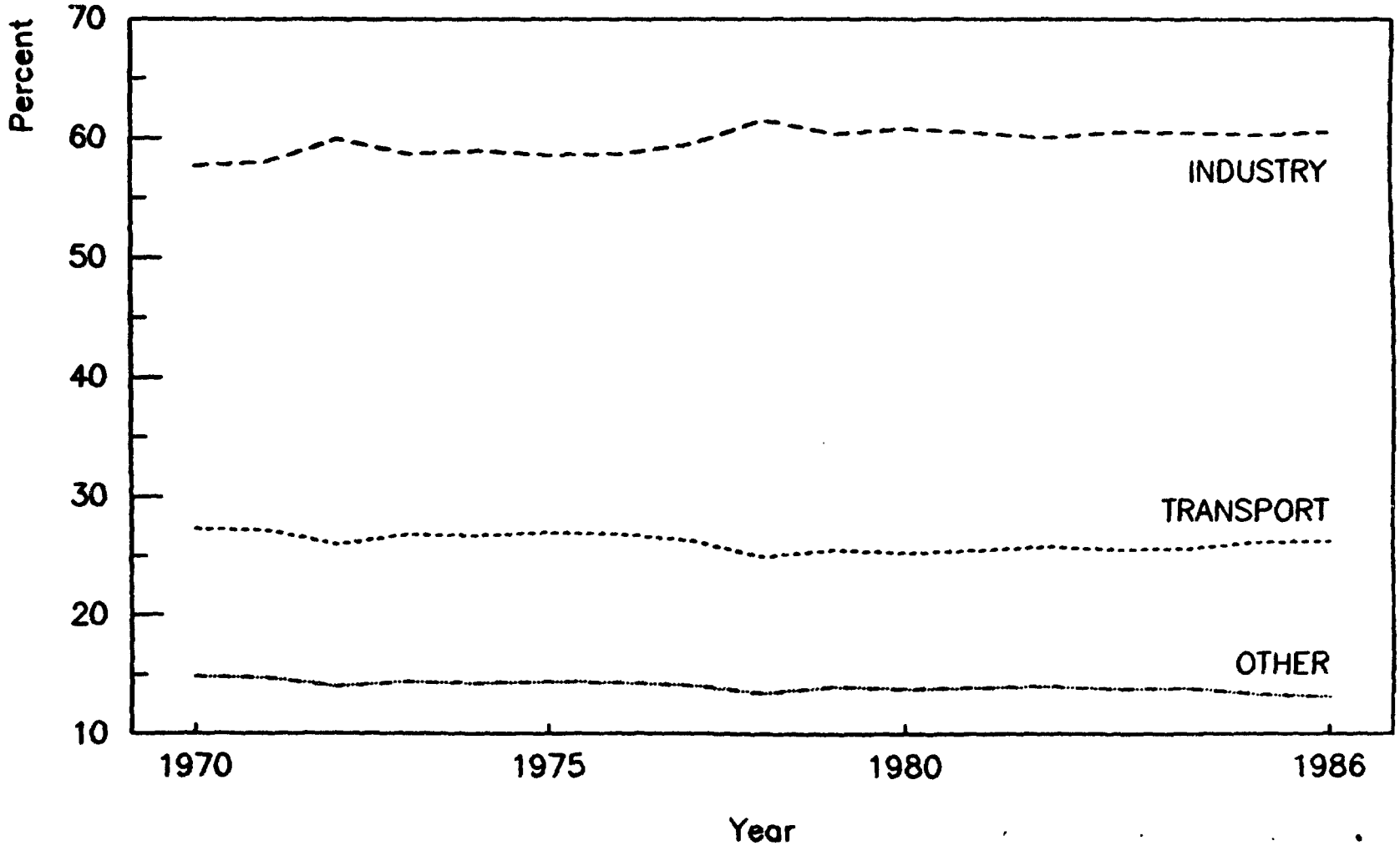


Figure 24

NON-CPE OIL CONSUMPTION BY SECTOR
1970-1986

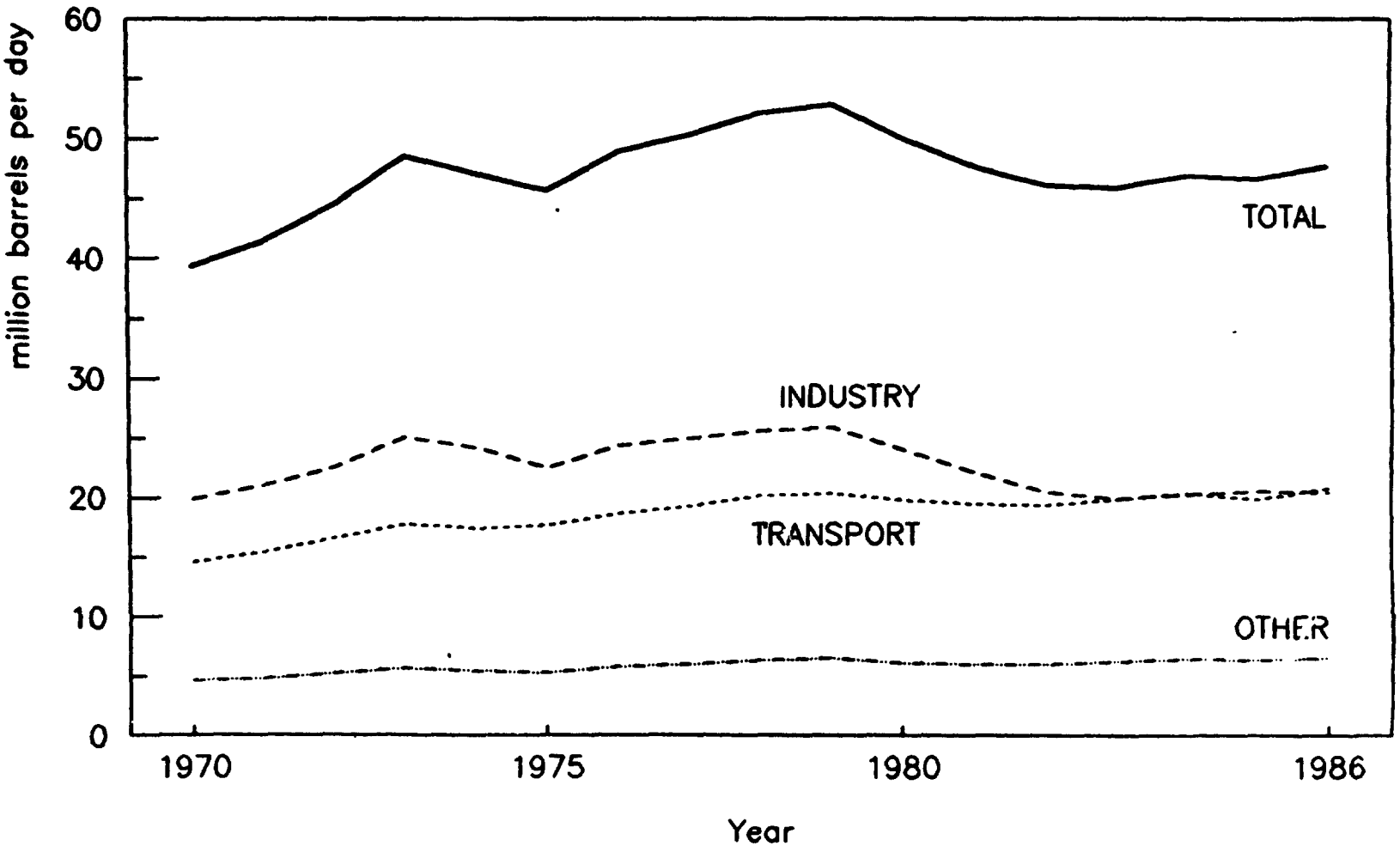


Figure 25

PERCENTAGE OF OIL CONSUMPTION BY SECTOR NONCENTRALLY-PLANNED ECONOMIES

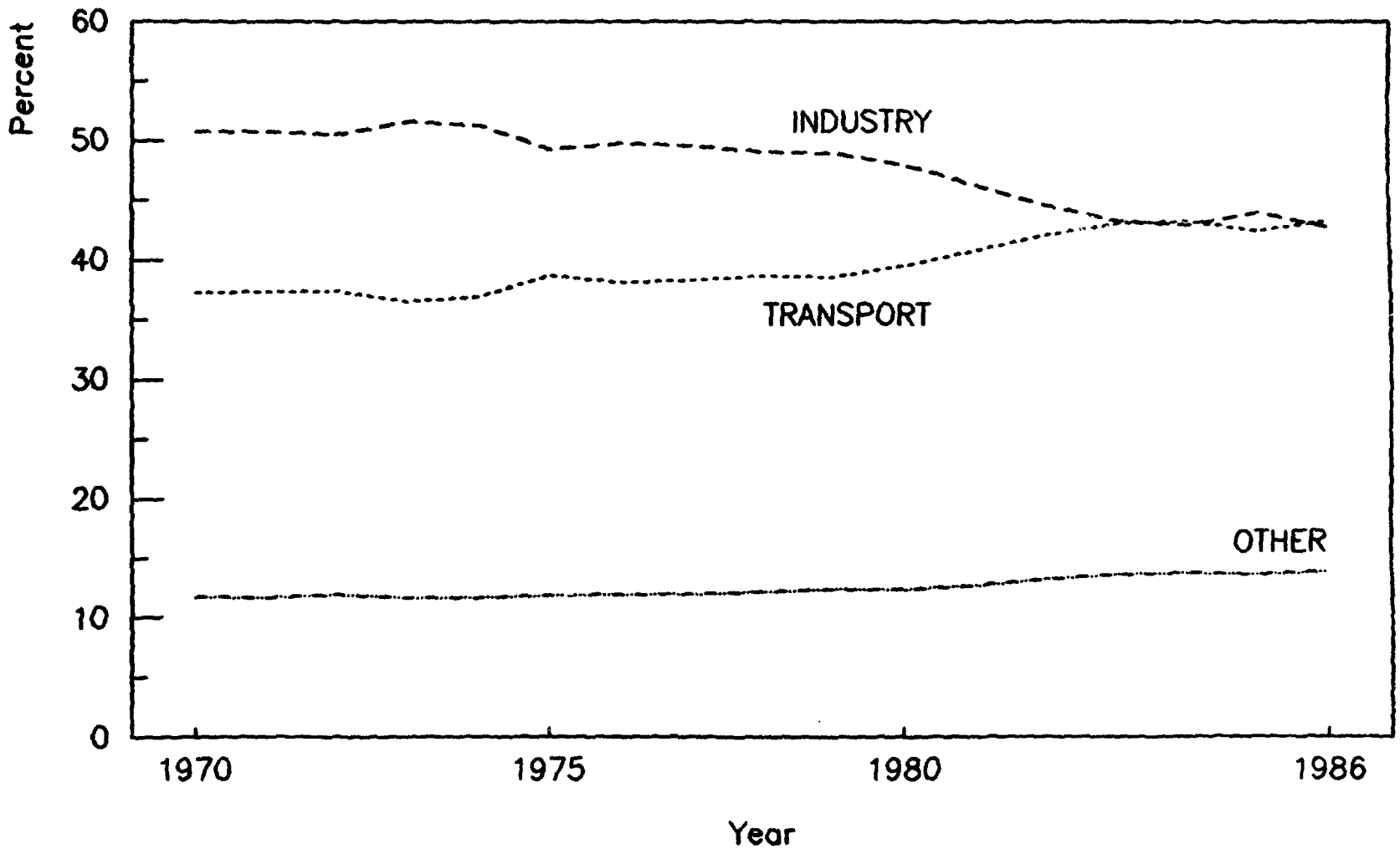


Figure 26

C. Oil Consumption in the Industrial Sector

Figures 27-29 use oil consumption data for various country groups from Part B and cross reference it in order to highlight the industrial and transportation sectors. The Figures are expressed in terms of volume (million barrels per day) and as percentages, i.e. oil consumption in the industrial sector worldwide as a percentage of world oil consumption.

Oil consumption in the industrial sectors of total world, total non-CPEs and in industrial countries has experienced fluctuations as a result of oil price changes. Comparatively, LDCs and CPEs have fluctuated less and maintained a more stable growth (Figure 27).

However, in terms of the industrial sector's oil consumption as a percentage of total oil consumption, the performances of LDCs, non-CPE and industrial countries are similar in the sense that they all experienced fluctuations during the oil price shocks (Figure 28).

Notwithstanding the high percentage of industrial oil consumption in LDCs due to the "industrializaton" effect, their industrial sectors are also becoming less oil-intensive. Therefore, focusing on LDC growth compared to the rest of the world in Figure 27, it is apparent that oil consumption in LDC industrial sectors is growing at a faster pace than the rest of the world, despite efficiency gains and any efforts to convert to other sources of energy.

CPEs, on the other hand, have not performed in a pattern similar to the rest of the world, perhaps because their economies, not being market oriented, are insulated from the oil price shocks experienced on the world's energy markets. Although the CPE industrial sector's oil consumption did not grow as fast as LDC's it is the most oil-intensive compared to the rest of the world (Figure 28).

OIL CONSUMPTION IN THE INDUSTRIAL SECTOR
1970–1986

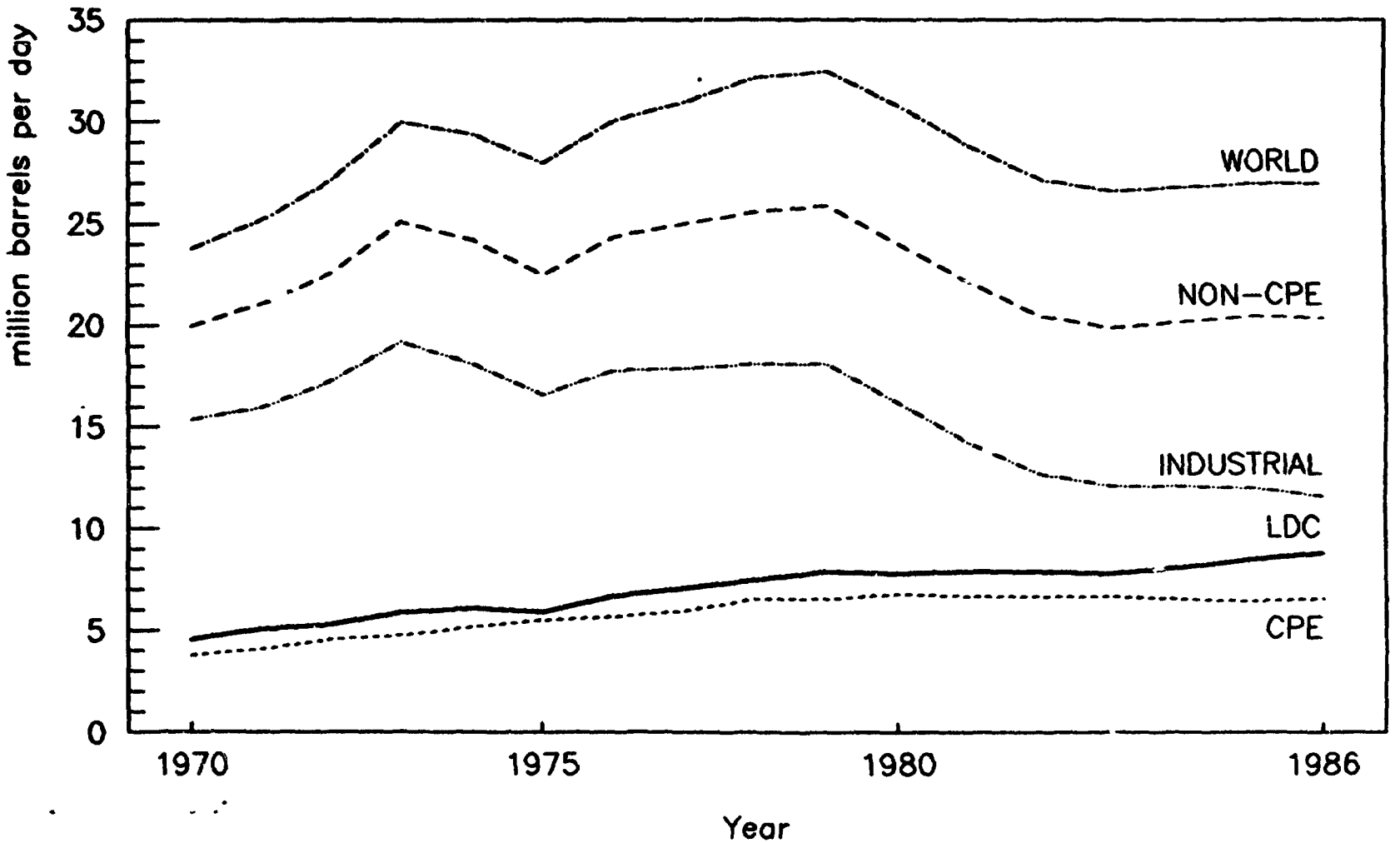


Figure 27

PERCENTAGE OF OIL CONSUMPTION IN THE INDUSTRIAL SECTOR

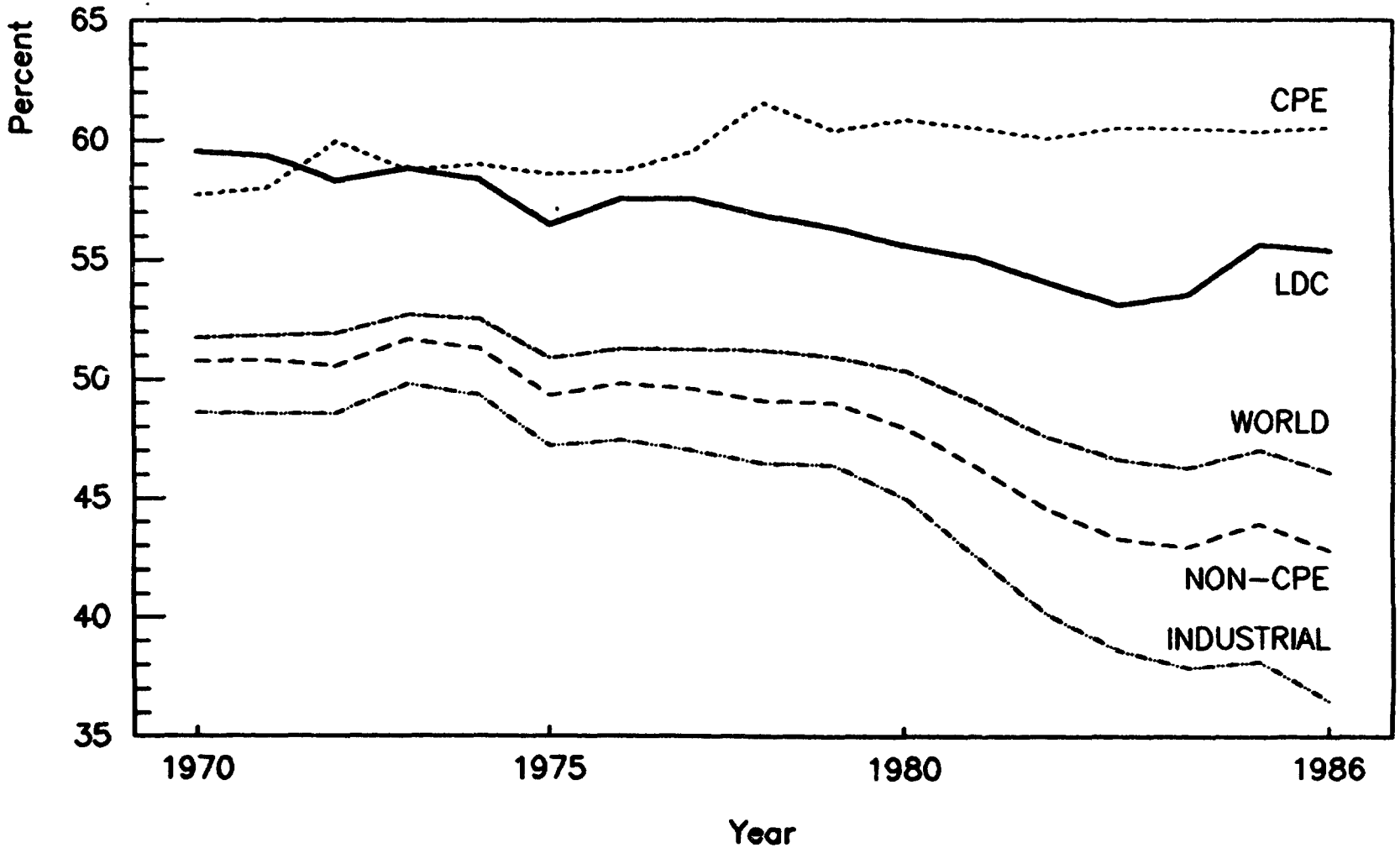


Figure 28

D. Oil Consumption in the Transportation Sector

Oil consumption in the transportation sector of the various country groups follows an opposite trend compared to consumption in their industrial sectors (Figures 29 and 30). This phenomenon supports the fact that fuel for transport is almost 100% oil-based, with some exceptions. Also technological breakthroughs and conservation have not increased efficiency gains to a degree that would offset growth in the other variables that influence oil consumption in the transportation sector, i.e. growth in economies, mobility, population and trade.

Figure 31 illustrates the motorization trend in several countries compared to their Gross Domestic Product (GDP) per capita. (This graph was developed by International Road Federation and reprinted in Shell's Matching Supply and Demand for Transportation in the Pacific Rim Countries in the Post 1990s). It shows that the high degree of motorization in countries such as Japan, which also have a high GDP per capita, whereas certain countries (Indonesia, South Korea) have similar cars/population ratios despite differences in GDP levels (500-5,000 GDP per capita). Nonetheless, the graph illustrates the higher degree of motorization in countries with higher GDPs resulting in higher oil consumption in their transportation sectors.

OIL CONSUMPTION IN THE TRANSPORTATION SECTOR 1970-1986

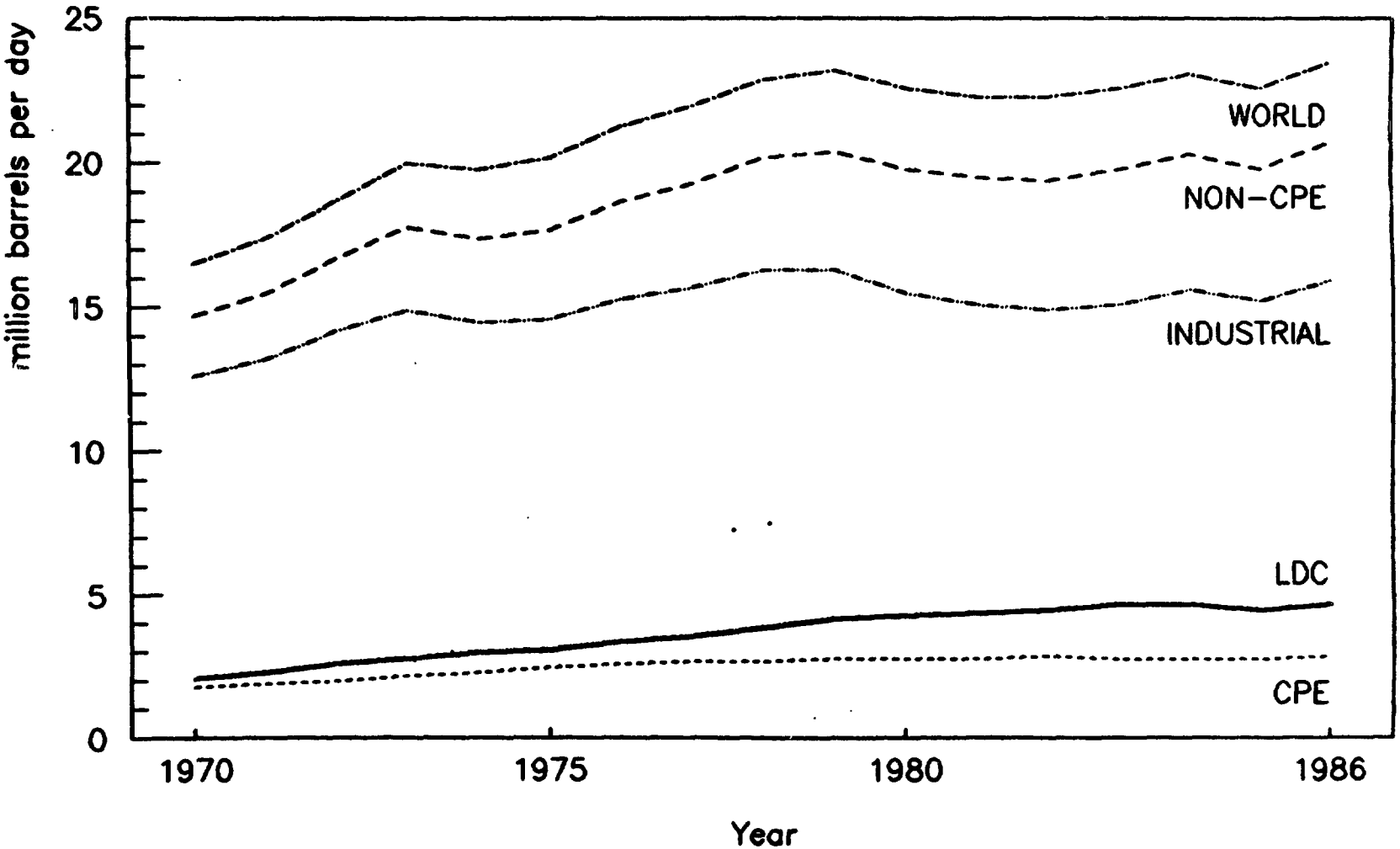


Figure 29

PERCENTAGE OF OIL CONSUMPTION IN THE TRANSPORTATION SECTOR

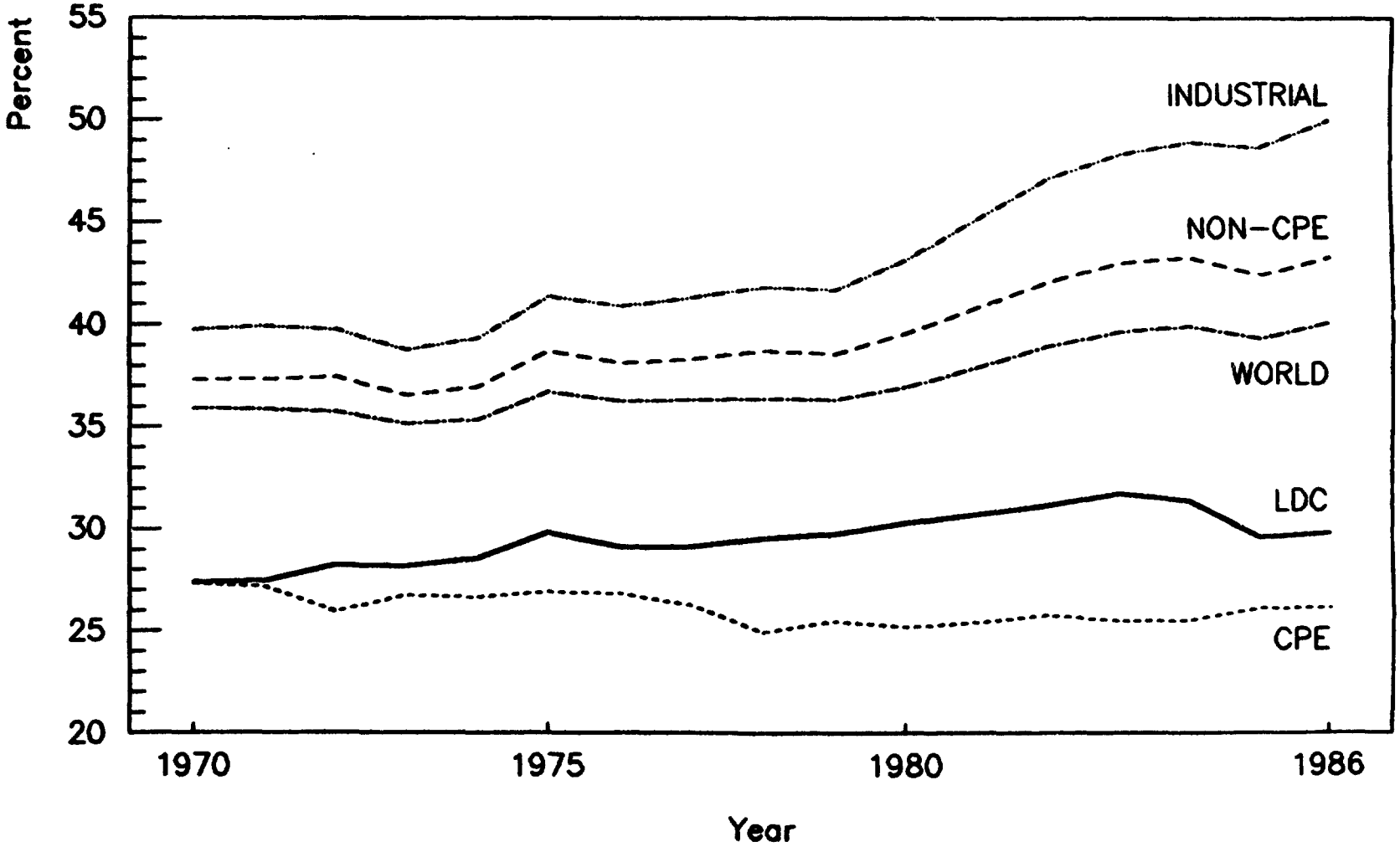
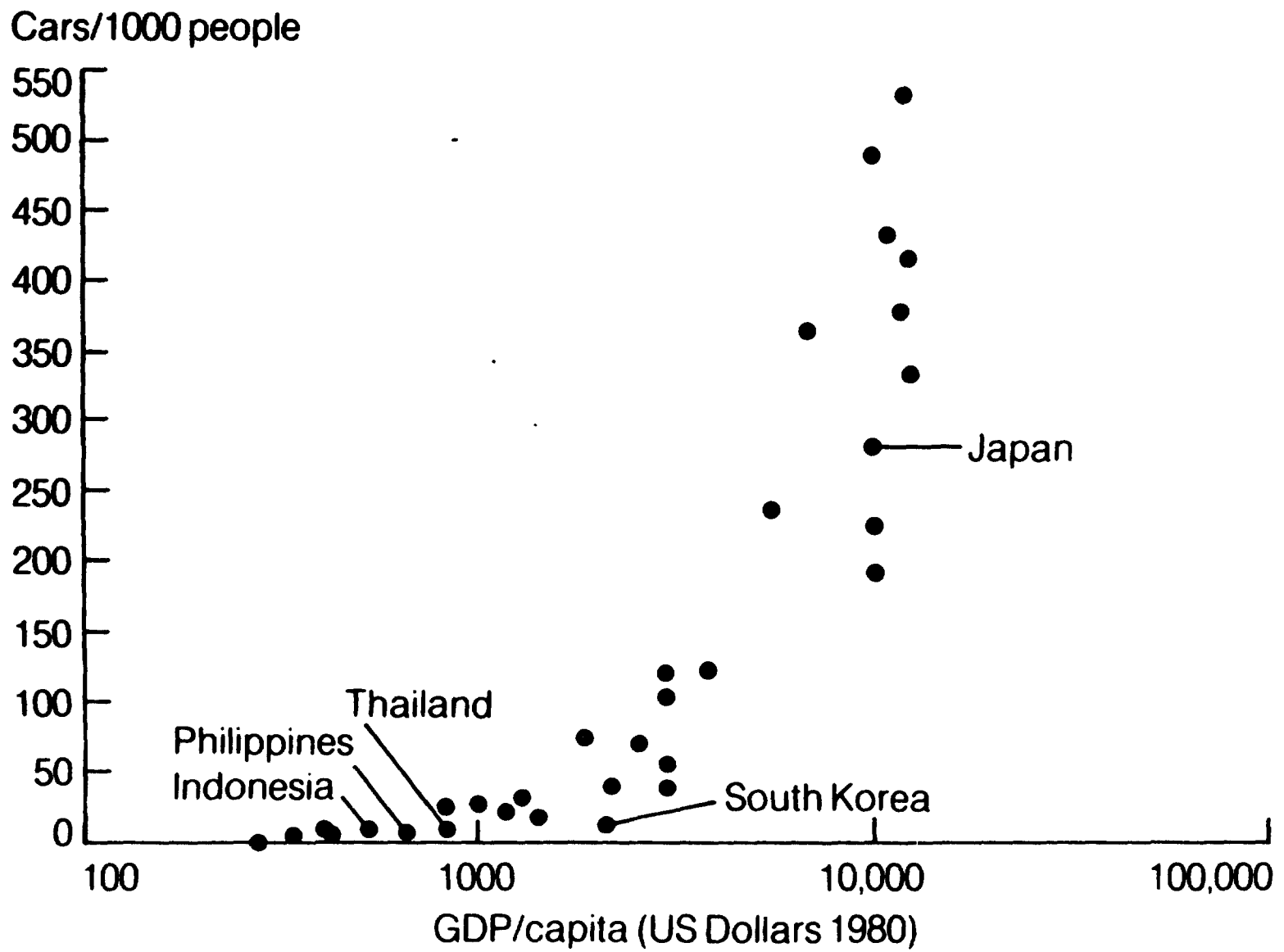


Figure 30



Source: International Road Federation

Figure 31

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